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A National Environmental/Energy Workforce Assessment

OREGON

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This study is one of 70 volumes assessing the workforce needs (manpower needs) for pollution control and abatement in the United States for the five-year period of 1976 through 1981. Seven fields for pollution control — air, noise, pesticides, potable water, radiation, solid waste, and wastewater — are analyzed, together with energy-related programs currently accentuated by the national effort to solve energy supply problems.

Designed as Phase I of a three-phase program, the complete assessment includes the following volumes: one each for the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands; one for each of the ten EPA regions; a one-volume National Abstract; a volume on National Legislation; a volume on Business and Industry; and a four-volume National Summary. The information was gathered through extensive personal interviews with responsible federal, state, and local officials in every state; with officials of representative private industrial and commercial firms; and with representatives of national industrial and trade organizations.

Phase II will develop a broad national inventory of the entire range of post-secondary and higher education training offered in the pollution control and energy areas cited above, and Phase III will offer demonstrations for curriculum changes or modifications which appear necessary to assure an adequate and properly trained national environmental/energy workforce.

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1977

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PREFACE

This study provides information on existing workforce levels, training programs, and career potentials and develops workforce projections (1976-1982) for the environmental pollution control fields of air, noise, pesticides, potable water, radiation, solid waste, wastewater, and energy conservation/conversion in the State of Oregon. The profiles and projections contained in this report are based upon available information obtained through various state agencies. The information and data presented in this study were obtained through extensive personal interviews with professionals working in the respective fields. The personal interviews were supplemented with information collected through telephone surveys and research.

This study was conducted under the direction of the United States Environmental Protection Agency by National Field Research Center, Inc., located in Iowa City, Iowa

FOREWORD

The materials contained in this report include information and data collected for eight individual pollution control inventories conducted for Oregon. The format includes workforce profiles, projections and career potential for each of the areas investigated. Projections were necessarily based on best professional estimates obtained through available information. The pollution control areas considered by this study are as follows:

Air
Noise
Pesticides
Potable Water
Radiation
Solid Waste
Wastewater
Energy

National Environmental Energy Workforce Assessment

Phase I

OREGON

State Summary

I. AIR

Air pollution control programs are administered through the Department of Environmental Quality, Air Quality Control Division. Staffing for the Division includes 36 professionals, 4 clerical positions, 1 student intern, and 1 I.P.A. position. Seven positions will be added to the Division during 1977; however, no further projections were made. The Vehicular Inspection program currently employs 20 inspectors, but this number fluctuates with the schedule of vehicle relicensure.

The nine Regional DEQ Offices provide an additional 18.6 person-years of support to the air program; the Regional Offices have a professional staff of 70 persons. During the next five years, the amount of effort allocated to air programs will most likely be reduced due to program priority reorientation. The projected level of support for 1977 is 17.3 person-years.

There is one regional air pollution control agency in Oregon: Lane Regional Air Pollution Authority. The Authority, which is currently staffed with 15 professional positions, anticipates only limited growth through 1982. Over the next five years, two inspector positions will be added, one in 1978 and the second in 1979. Applicants recruited for the positions will be degreed civil or mechanical engineers.

Research indicates that in excess of 40 professionals are employed in air programs in the private sector; these professionals frequently have degrees in engineering. The private sector workforce appears to have stabilized.

II. NOISE

Noise pollution control and abatement programs are the administrative responsibility of the Oregon Department of Environmental Quality. The Air Quality Control Division, Noise Section has a staff consisting of four professional/technical positions including one engineer, one noise pollution supervisor, and two noise technicians. The Section has requested an additional engineer for 1977 and projects that two to three engineers and one environmental technician will be required before 1982. Expanded program priorities for the Section include emphasizing control of noise at airports, race tracks, and highway construction sites.

The Oregon Department of Transportation administers a traffic noise control program. Three engineers, whose principal activities include noise abatement and control, are currently employed by the Department. Two additional positions, one engineer and one technician, have been requested for 1977. The Department further estimated that two positions would be necessary if program activities in mass transit and airport noise are pursued.

Five municipalities in Oregon had Municipal Noise Ordinances as of 1975; however, Portland offers the most comprehensive program. The Portland Bureau of Neighborhood Environment, the noise control agency, is staffed with three full-time noise specialists. The Bureau does not predict any growth through 1982

Workforce information on the private sector is limited; sources indicated that up to twenty persons are active in technical noise consulting. Projections for the private sector are not available.

III. PESTICIDES

Within the Oregon Department of Agriculture, the Plant Division controls and regulates the use of pesticides and the Laboratory Services Section performs analyses on pesticides, pesticide formulations, pesticide residues, and plant foods. A cumulative staff of 50 persons provide support to the range of pesticide programs administered through the Department. Both the Plant Division and the Laboratory Services Section project an annual growth of 10 percent through 1982.

The Oregon State University Extension Office has one part-time coordinator, one entomologist, one graduate assistant, two secretaries, and six state pesticide specialists who have responsibilities under some aspect of the private and commercial pesticide applicator training programs. The 78 county extension staff members also provide support in the training. The future level of staff support is currently in question; sources indicated that staffing is dependent on continued federal funding.

There are an estimated 250 to 300 commercial pesticide applicator firms that employ an estimated 1,200 to 2,000 applicators. Sources also suggested that there are approximately 3,000 licensed pesticide consultants and 28,000 to 30,000 farmers in the state who apply pesticides. Up to 1,000 persons are also involved in pesticide research and application. No estimates are available on private sector workforce requirements through 1982.

IV. POTABLE WATER

As of July 1, 1977, there will be no state operated potable water program. Early in 1977, the Governor's Office recommended the dissolution of the potable water program, which had previously been administered through the Oregon Department of Human Resources, Office of Sanitation Services. The U.S. Environmental Protection Agency, Region X Office will assume temporary authority for these programs; however, the regional office has noted its intention of negotiating an arrangement with the state to restore the program to the state government.

The Region X Office will be staffing a field office in Portland. Sources indicated that eleven persons will be hired to operate the Oregon program. This will consist of one engineer, one attorney, two secretaries, and seven other professionals. It is anticipated that persons with skills and training in engineering and the physical/biological sciences will be recruited for the professional positions. No growth projections were made for this field staff.

There are 727 community water supplies in the state; however, 55 of the supplies provide service to 47 percent of the state's population. Sources within the state indicated that there are an estimated 299 persons employed in potable water-related jobs. This includes 199 operators, 34 maintenance workers, 18 mechanics, and 56 others. Little change is projected for the private sector workforce during the next five years.

V. RADIATION

The Oregon Department of Human Resources, Radiation Control Service is the primary environmental radiation and radiological health administrative agency. The Service has a total of 20 authorized positions. A proportion of the professional staff have experience and training as radiation health physicists, radiation chemists, and radiation specialists. The Service projects minimal growth during the next five years, with a cumulative increase of only one position.

Information on private sector workforce occupations for the State of Oregon is limited. It has been projected that as many as 1,000 persons may be employed in "radiation control" programs, with a majority of the persons having backgrounds in engineering.

In a 1975 study entitled An Analysis of Nuclear Related Technician Manpower in Western States, the Energy Research and Development Administration stated that there would be an estimated 913 persons active in the Nuclear Related Technician Workforce in the State of Oregon in 1976. The study reported that by 1977 a total of 983 persons would be required in the nuclear related technician workforce. The annual increase for personnel in this field has been estimated at 8 percent. If this trend continues, by 1981 there will be approximately 1338 employees in the nuclear related technician workforce in Oregon.

Sources noted an emerging interest in non-ionizing radiation research; this may generate a long-term impact upon the private and public sectors.

VI. SOLID WASTE

Administrative authority for solid waste management programs is under the Oregon Department of Environmental Quality, Solid Waste Division. Thirteen professionals are currently employed in the Division. No growth is planned during the next five years. Nevertheless, if any new federally funded programs were implemented, e.g., resource conservation and recovery, additional staff will be required.

The Regional Offices currently provide 5.3 person-years of support to the Divisions; this level is projected to grow to 11.7 person years during the next two years. The Laboratories and Research Division provide an estimated 1 person-year of analysis, and no growth is projected in the level of support.

The Oregon Liquor Control Commission operates the Oregon Beverage Containers Certification Program. The commission indicated that the program is self-contained and that less than one person-year of effort is required to administer the program.

Private sector projections are limited. No data is available on the landfill workforce. The one operable hazardous waste site is staffed with three operators and one secretary. Three engineers provide auxiliary technical support to the program. There are no resource recovery processing facilities in Oregon. Information on collection systems is not available. Growth in the landfill, hazardous waste, and collection system workforces will be limited through 1982. Substantial growth is expected in the resource recovery field, as the four planned facilities become operational and employ 40 persons.

VII. WASTEWATER

The Department of Environmental Quality, Water Quality Division has primary responsibility for wastewater control and abatement programs for the State of Oregon. The division has 35 authorized positions which include 27 professionals, 1 technician, and 7 secretaries. No staffing increase is projected through 1982. The DEQ regional offices provide an estimated 30.7 person-years of support to the Water Pollution Control Program and 19.6 person-years of effort to the Subsurface Sewage Program. DEQ predicts a decrease in the percent of staff effort allocated to these two programs. During the next fiscal biennium, only 48.4 person-years of effort will be devoted to these programs.

Four Councils of Governments are recipients of 208 Planning grants. An estimated 16 professionals are employed in 208 activities. An additional 41 persons are involved in local 208 programs. The future staffing of these programs are dependent on the level of local funding.

Field research indicates that between 650 and 700 persons are employed in wastewater-related occupations in municipal treatment facilities. No estimate is available on the number of employees in the industrial and agriculturally related wastewater treatment facilities. No major growth is expected in the private sector during the next five years. The state is attempting to limit rising costs through consolidation of smaller facilities.

VIII. ENERGY

The Oregon Department of Energy, which was created in 1975, coordinates a broad spectrum of energy related programs. At present, the Department has a full staff of 30 members: 25 professionals, 4 secretaries, and 1 temporary student worker. During the next fiscal biennium, the Department expects to expand its staff to 43 positions. The greatest growth will occur in the administrative and engineering categories. The Department was hesitant to make staffing projections through 1982 due to the recency of the program's organization.

The Energy Policy Review Committee provides policy and advisory support to the Department. The Committee consists of nine members: three Governor appointees, three House appointees, and three Senate appointees.

Comprehensive information of the private sector energy related workforce is currently unavailable. Most utility companies have environmental components which have responsibilities related to planning, air pollution control, environmental noise control, and wastewater pollution control. One example of such a component is the Portland General Electric Company, Department of Environmental Services. The twelve member staff have professional experience in several disciplines including biology, meteorology, physics, geography, radiation technology, and engineering. In addition to the Department of Environmental Services, it is projected that 20 to 25 persons in other departments provide support to the program.

STATE OF OREGON - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR[1]	90	95	96	97	97	97	2%
NOISE[2]	20	20	20	20	20	25	5%
PESTICIDES[3]	71	74	75	81	85	90	5%
POTABLE WATER[4]	299	310	310	310	310	310	1%
RADIATION	934	1,004	1,083	1,169	1,261	1,360	8%
SOLID WASTE[5]	18	25	25	25	25	25	8%
WASTEWATER[6]	78	76	76	76	76	76	-1%
ENERGY[7]	30	43	43	43	43	43	9%
TOTALS	1,540	1,647	1,728	1,821	1,917	2,026	6%

[1] No estimates were available on the private sector workforce for air programs.

[2] These figures include estimates for the state program and limited information on the private sector.

[3] The above does not include the estimated 28,000 to 30,000 farmers, 3,000 pesticide consultants, 1,200 to 2,000 applicators, and 1,000 private researchers.

[4] These estimates include only workforce information on the U.S. EPA, Region X field office staff and the private sector.

[5] These estimates do not include the private sector.

[6] These estimates do not include private sector projections.

[7] The above does not include private sector workforce information.

EDUCATION

The State of Oregon offers a variety of environmentally-related programs throughout its educational system. There are programs on the graduate, four-year, two-year, and one-year level available to persons interested in obtaining degrees, certificates, or diplomas.

Linnfield College and Oregon State University are two of the four-year institutions which offer degrees in the environmental field. Two-year institutions which offer either degrees, certificates, or diplomas or simply environmental courses include Clackamas Community College, Umpqua Community College, Linn-Benton Community College, Treasure Valley Community College, Southwestern Oregon Community College, and the Oregon Institute of Technology. Programs include environmental health, environmental health technology, wastewater technology, water treatment/wastewater technology, water/wastewater plant operations, environmental sciences, and environmental studies.

In the State Report a more detailed outline of programs at Linn-Benton Community College and Oregon State University are presented.

LEGISLATION

The environmental/energy legislation for Oregon was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Environmental Quality Commission Law
Air and Motor Vehicle Pollution Control Law
Noise Control Law
State Pesticide Control Act
Beverage Container Law
Hazardous Wastes Law
Solid Waste Management Law
Sewage Treatment and Disposal Systems Law
Water Pollution Control Law
Law Relating to Detergents
Comprehensive Land Use Planning Law
Energy Conservation Law

National Environmental Energy Workforce Assessment

Phase I

OREGON

State Report

STATE PROFILE

Oregon as a territory once comprised what is now termed the Pacific Northwest; as a state it is diverse in nature yet very representative of this region of the country. The population of Oregon is slightly over 2,000,000, with 87% of this total west of the Cascade Range and largely in the Willamette Valley.

The rich outdoor resources and the Pacific coast of Oregon attracted the first permanent settlements to the state in the nineteenth century. By 1859, Oregon was admitted to the Union and subsequent railroad development increased growth of the state. Since the early twentieth century, Oregon has experienced the same rural-to-urban shift as the rest of the nation and now two-thirds of the people reside in cities.

Approximately one-half of the land area of Oregon is forested, and forestry provides the economic base for the state. Nearly 50% of the state's 5,000 manufacturing establishments deal with forest products, and Oregon ranks as the leading state in softwood lumber. Plywood, pulp and paper plants are also key industries. Metals-related industries and food processing are the two other major manufacturing contributors.

Wheat, vegetables, fruit and cattle are Oregon's main agricultural assets. Various types of salmon and shellfish dominate an active fishery industry. Mineral production in Oregon is fairly limited with sand and gravel comprising the bulk of the value; however, the nation's only nickel mine is located near Riddle, Oregon.

Oregon's physical diversity is demonstrated by the moist forest and mountains and fertile valleys of the western third and the arid, harsh deserts of the eastern area. Some of the nation's best-known rivers--the Columbia, Snake and Willamette--either border on or flow through Oregon. Much of the eastern plateau is naturally dry, although parts have been irrigated, and wheat growing and other agricultural activities take place on sparse, large ranches.

Approximately two-thirds of the state population resides in or around Portland, Eugene, and Salem. Portland is the largest city in Oregon and is rapidly gaining importance as a Pacific port and as a commercial, industrial and cultural center of the region. Salem is the state capital and is one of the leading food processing centers in the country.

The "Oregon System" has provided a number of innovations to state government; the initiative, referendum and recall concepts were originated in Oregon in the early twentieth century. The state allows local home-rule government and a state government similar to most others in the country.

Oregon has a richly-deserved outdoor heritage because of its scenic wonders and natural resources. In many respects the state has been a vanguard on environmental matters as it struggles to maintain its status. A growing population and more industrialization have been major concerns in recent years. Economic growth and outdoor resources will continue to make Oregon an attraction in the coming years; because of the state's demonstrated environmental concern the natural beauty of the state will, no doubt, be preserved in the modern world.

OREGON POLLUTION CONTROL AND ABATEMENT AGENCIES

In Oregon, the principal pollution control and abatement agency is the Oregon Department of Environmental Quality, headquartered in Portland, Oregon. The department has five administrative offices and five basic program divisions. The administrative offices include: Technical Coordination, Hearing Section, Administrative Programs, Personnel, and Information and Education. The five program areas are: Air Quality Control Division, Water Quality Division, Regional Operations, Solid Waste Management Division, and Laboratories and Applied Research.

This study was designed to assess workforce profiles and projections for air, noise, pesticides, potable water, radiation, solid waste, wastewater, and energy conservation/conversion; however, the Oregon Department of Environmental Quality does not strictly follow these categories in the organization of its divisions. For example, the Air Quality Control Division has responsibilities for air programs, noise programs, and the motor vehicle inspection program. Consequently, when the Air Quality Control Division's staffing level is discussed in a section of this study, only those employees with related activities are included in the tabulation.

The Department of Environmental Quality employs 179 persons in the central office and 88 persons in the nine regional offices. Within the central office, there are 25 administrative persons, 25 clerical employees, 79 professionals, and 47 technical positions. Turnover for the department has been estimated at 30 percent per annum. All position vacancies are filled through the State Civil Service System.

Growth in the Department of Environmental Quality will be quite limited during the next biennium. The Air Quality Control Division predicts a 4 percent per annum growth over the next two years, and the solid waste, noise, and wastewater programs do not anticipate any growth over the next two years. The Department of Environmental Quality indicated that all programs would be relatively stable through 1982.

The regional offices will experience some growth in staff during the next biennium; however, the regional offices will also be experiencing a reorganization of program priorities. The regional offices will be placing greater emphasis upon solid waste and noise pollution control and abatement activities. There will be a consequent decrease in the focus on air and water pollution control programs.

An organizational chart for the Oregon Department of Environmental Quality is included with this section to illustrate the relationship of the five program divisions to the administrative offices.

The Oregon State Department of Agriculture is the state lead agency for pesticide programs. The Plant Division and the Laboratory Services Section are involved with pesticide registration, identification, and analysis programs. Within these two program divisions, the Department of Agriculture employs 3 administrators, 13 technicians, 34 professionals, and 4 secretaries. The department expects to experience a 10 percent per annum growth over the next five years.

The department coordinates the Pesticide Applicator Certification Program with the Oregon State University Extension Office. The extension office offers training for both commercial and private applicators. The extension office employs 1 administrator, 8 professionals, and 2 secretaries, all of whom have part-time training program responsibilities. Limited growth is expected in this program; in fact, any growth will be a consequence of increased federal funding.

The Department of Transportation has a traffic noise control program. The basic thrust of this program is to evaluate highway projects with regard to existing and projected noise burdens that will be generated by the increased usage. The program is currently operated by three professional engineers. The department indicated that consideration is being given to expansion of the program to include mass transit, airport, and airway noise control If these programs are integrated into existing department activities, there will be a decided need for increased staffing.

The Oregon Department of Human Resources has administrative responsibility for the radiation program and was the state lead agency for potable water programs prior to July 1, 1977. Early in 1977, the Governor's Office recommended elimination of the existing public water supply program. Consequently, the U.S. EPA, Region X Office will assume temporary authority for the program. Under it radiation program, the department of Human Resources employs 1 administrator, 14 professionals, 1 technician, and 5 secretaries. Limited growth is projected for the next five years. Only one position will be added to the staff in 1979.

State energy programs are coordinated through the Oregon Department of Energy. The agency was created in 1975 in response to the emerging state energy problems. The Department is currently staffed with 8 administrators, 18 professionals, and 4 clerical positions. The department anticipates an increase of staff by 13 positions during the next biennium. The greatest growth will be in the administrator and engineer categories. The department was hesitant to make staffing projections past the next fiscal biennium, 1977-79, due to the recency of program establishment.

Oregon's Beverage Container Law is administered by the Oregon Liquor Control Commission. The law is an attempt to curtail littering of beverage cans and bottles. The commission indicated that the program was self-contained and did not require a full-time staff.

In summary, an estimated 380 persons are involved in environmentally-related programs in the State of Oregon. This number includes: 38 administrators, 153 professionals, 61 technicians, 40 clerical persons, and 88 others. The Other category consists of the persons employed in the Oregon Department of Environmental Quality Regional Offices. No breakdown of occupational types was provided on the regional offices.

In terms of program emphasis, the state will be reorganizing environmental priorities to include greater focus on energy, noise, solid waste, and pesticide programs. Of particular concern will be resource recovery, hazardous waste, and energy conservation. The radiation, air, and wastewater programs have reached a plateau in service delivery, and they will experience only limited growth and diversification during the next five years. Of particular interest in Oregon is the current status of the potable water program. Early in 1977, the Governor's Office recommended a discontinuance of the public water supply program, and in the state's budget recommendations, the state support for the program was terminated. U.S. EPA, Region X is assuming temporary responsibility for the program; however, during the next two years, the Region X Office will be working with the state to restore the supervisory authority for the potable water programs to the state.

Pollution Control and Abatement Programs

I. AIR

A. Introduction

Air pollution control programs in the State of Oregon were authorized as early as 1951. The programs were organized under the State Sanitary Authority which also had administrative responsibility for governing water quality activities. In 1969, the Department of Environmental Quality was established. The legislation which created the Department also included a number of provisions which inherently strengthened the administrative basis of air pollution control programs. The legislation instituted a tax relief program for facilities utilizing air pollution control devices. In 1971, the Air Quality Act was also amended. The focus of the amendments provided for the following program activities:

1) review of new source construction;
2) measurement and testing of air emission sources;
3) registration and reporting of all sources.

Other program activities which were implemented during 1971 include the Air Contaminant Discharge Permit Program, Motor Vehicle Inspection, and a source inspection program which is enforced through a schedule of fines and other civil penalties.

The Department of Environmental Quality, Air Quality Control Division is the state lead agency for air pollution programs. The Division has defined the following administrative program goals:

1) to maintain compliance with Federal and State Air Quality Standards in present compliance areas and to improve the overall compliance of permitted sources at greater than the 95 percent level;

2) to attain and, thereafter, maintain compliance with Federal and State noncompliance areas by June 30, 1979;

3) to improve the air quality monitoring network and data base to ensure that the best information is available for assessment, attainment, planning, evaluation, and public information;

4) to accommodate desirable growth and development while attaining and maintaining compliance with air quality standards;

5) to prevent deterioration of air quality in designated areas of the state having special historical, cultural, conservation, or recreational values, and to prevent significant deterioration of air quality in the state where air quality is cleaner than required by existing standards;

6) to maintain the air quality impact of open field burning to lowest practical levels;

7) to maintain air quality impact of forest burning to lowest practical levels and recycle usable residues;

8) to maximize direct field enforcement of air quality activities;

9) to maintain an adequate data base for air quality, emission, and meteorology by use of automatic systems to minimize workforce requirements.

The Division has developed a series of program strategies which will ensure that these program objectives are attained during the next three to five years.

The air pollution programs of the Division are administered through three sections: 1) Planning and Development; 2) Operations; and 3) Data Aquisition Analysis and Reporting. The Planning and Development Section is responsible for the following activities:

1) development of control strategies for air monitoring and coordination of air quality maintenance;
2) preparation of annual reports and other special studies; and
3) review of new source Prevention of Significant Deterioration studies.

The Operations Section is principally responsible for permit issuance and compliance and administration of the tax relief program. As the name infers, the Data Aquisition Analysis and Reporting Section administers the data processing for the emissions inventory, the field burning program, source field testing, and special assistance program.

Another responsibility of the Air Quality Division is the supervision of the Vehicle Inspection Program. The Vehicle Inspection Program was implemented in late 1973. Legislation requires that vehicles must be inspected prior to relicensure. While the existing state regulations require biennial inspection of vehicles, sources within the Department of Environmental Quality indicated that consideration is being given to annual inspection.

B. Workforce Profile

The Air Quality Control Division has 37 authorized professional positions. All but one of these positions is filled; a vacancy currently exists in the public health engineer category. In addition to the 36 professional staff members, the program has four clerical positions, one student intern, and one I.P.A. position. The following table represents the distribution of the professional staff by occupational type:

TABLE I

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Air Quality Control Division
Current (1976) Staffing Level

Position	1976
Engineer	14
Administrator	4
Meteorologist	1
Environmental Specialist	6
Environmental Technician	8
Other	3
TOTAL	36

The Other category includes one key punch operator and two programmers/analysts.

The Air Quality Control Division recruits all levels of personnel through the State Civil Service System. The turnover for the Division averages approximately 10 percent annually. The relatively high turnover rate is considered a function of the low salary scales as compared to the private sector and the federal agencies.

There are nine Department of Environmental Quality Regional Offices: Portland, St. Helens, Salem-North Coast, North Coast, Midwest, Southwest, Coos Bay, Central, and Medford. Including the administrative support to the regional offices located in the state headquarters, a total of 88 persons are employed in regional office operations. The following table is a breakdown of staffing in the regional office program by occupational category.

TABLE II

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Regional Office Operations
Current (1976) Staffing Level

Position	1976
Administrator	3
Engineer	23
Environmental Specialist	22
Sanitarian	17
Chemist	1
Technician	4
TOTAL	70

The regional offices allocate approximately 18.6 person-years to the air pollution control program; this is equivalent of approximately 26 percent of the staff effort. No statistics were available on the turnover rate for the regional offices. As with the Air Quality Control Division, all position vacancies are filled through the State Civil Service System.

There is only one regional air pollution control agency in Oregon. The Lane Regional Air Pollution Authority, which is located in Eugene, Oregon, is currently staffed with a total of 15 professionals. The professional staff is supported through the efforts of three general office staff members. The following table provides an overview of the professional staffing pattern by occupational type.

TABLE III

STATE OF OREGON

Lane Regional Air Pollution Authority
Current (1976) Staffing Level

Position	1976
Administrator	2
Engineer	4
Inspector	4
Chemist	1
Other	4
TOTAL	15

The Other category consists of one attorney, one public information specialist, one technician, and one administrative assistant. Turnover for the agency averages approximately 10 percent annually. Sources in the field indicated that the majority of the turnover was a consequence of better salaries and promotional opportunities within the private sector and federal agencies. As vacancies occur within the department, numerous methods are utilized to attract interested applicants. The department notifies the State Civil Service System and the state employment office. In addition, the department also sends notices to private bureaus and agencies.

The Laboratories and Applied Research Divisions provide staff support to the air program. In the ambient air program, eight persons provide supportive laboratory services. The eight staff members include: one administrator, one chemist, one environmental specialist, and five environmental technicians.

Laboratory staff support under the source sampling program approximates six persons: four chemists and two technicians.

In an attempt to assess the workforce situation in the private sector, a variety of research methods were employed. Representatives at the Air Quality Control Division and the Regional Air Pollution Authority were asked to estimate the number of persons involved in air pollution control and abatement activities within private industry. In addition, these estimates were supplemented with information provided through correspondence with private industries and utilities within the state.

While it should be noted that information in this section represents "best professional estimates" of professionals practicing within the field, it is reasonable to predict that in excess of 40 full-time equivalent professionals are employed in private industry in air pollution control related activities. Most frequently these professionals have both experience and training in engineering. No estimate was available as to the number of technical persons employed in the 311 major and 70 minor installations in the state; however, evidence gathered through correspondence with private industry indicates that the number of persons with such auxiliary functions as maintenance, laborer, and operation is significant. Field research also suggests that the workforce in the private sector is relatively stable, with an average annual turnover rate no greater than five percent. The stability of the workforce reflects good salaries and employee benefits.

Private industry employs varied recruitment methods which include advertising in state and local newspapers and professional journals, and by contacting and interviewing persons employed at other agencies.

C. Workforce Projections

The Air Quality Control Division anticipates only limited staff growth during the next five years. The Division experienced a major staffing increase in 1971 in response to legislative mandates; however, from 1971 to present, the program staffing requirements have remained relatively stable. The following table illustrates the anticipated growth by professional position within the Division over the next five years.

TABLE IV

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Air Quality Control Divison
Workforce Projection to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	14	18	18	18	18	18		6%
Administrator	4	5	5	5	5	5		5%
Meteorologist	1	1	1	1	1	1		0%
Env. Spec.	6	7	7	7	7	7		3%
Env. Tech.	8	8	8	8	8	8		0
Other	3	4	4	4	4	4		7%
TOTAL	36	43	43	43	43	43	10%	4%

The seven positions being added in 1977 are necessary to provide improved services under existing functions. No expansion in program services or activities is expected. The Division did not wish to speculate on staffing requirements past 1977-1978, since numerous uncontrolable factors influence the program operation. However, representatives from the Division indicated that they did not anticipate any major changes in staffing requirements if the Clean Air Amendments were adopted.

No growth is anticipated in the level of support provided by Laboratories and Applied Research Division.

The Regional Office Operations project that the amount of staff effort allocated to air pollution control programs during the next five years will be slightly reduced. For the 1977-79 biennium, the Regional Offices estimate that no more than 20 percent of their staff effort will focus on air programs; this amounts to an estimated 17.3 person-years. Overall the Regional Offices will experience growth in their staffing; however, the program orientation will be reorganized to include greater emphasis upon noise control, subsurface sewage, and solid waste. During the 1977-79 biennium, the proposed authorized staffing level of the Regional Offices is 82 positions.

As with the State Agency, the Lane Regional Air Pollution Authority projects only limited growth during the next five years. Nevertheless, sources at the Authority indicated that two additional inspectors would be necessary within the next three years. It is anticipated that one inspector would be added during 1978 and the second inspector would be authorized no later than 1979. The Authority indicated that it would interview only those applicants with a minimum of two years experience as mechanical or civil engineers. These two positions would be necessary as a consequence of improved air quality standards and the rapid population growth.

In defining the estimated growth/decline in the availability of air pollution control positions within the private sector, the same method was employed in securing estimates for growth projections as was used in determining the current status, e.g., interviews and correspondence with state and regional air pollution control agencies, private industry, and utilities. Field research suggests that the private sector workforce will remain relatively constant through the next five years. This estimate is predicated on the assumption that no new federal or state legislation will be introduced which would require increased compliance activities.

D. Training and Certification

Oregon has a Visible Emission Certification and Training Program. The program, which was implemented in 1969, is administered through the Laboratories and Applied Research Division. The training program is offered in Portland an average of fourteen times per year, with an estimated ten persons attending each session. During 1976, approximately 150 persons were trained; however, only 51 percent of the persons attending pass the certification examination for black smoke and only 44 percent pass the examination for white smoke. All persons participating in the program are employed as government inspectors and industrial representatives.

The Laboratory anticipates both an increase in the number of persons participating in the program and an expansion of the existing training program. Sources in the program indicated that a new smoke generator would significantly improve the quality of the program; indeed, plans are being developed for construction of a mobile smoke generator which would provide for greater accessibility of the program.

The Department of Environmental Quality also offers a Motor Vehicle Inspector Training Program. The program is operated through the Air Quality Control Division. The program began in 1973, and between 1973 and 1976, a total of 98 inspectors were trained. The training program consists of 160 hours of instruction, with 40 hours of in-class instruction and 120 hours of on-the-job training. The course is available only in the Portland area.

There are currently 20 state vehicle inspectors; however, by January, 1978, a total of 75 inspectors will be necessary to accommodate the requests for vehicular inspection prior to relicensure. Consequently, during the last quarter of 1977, approximately 55 inspectors will be trained. It is noteworthy, that by July, 1978, the number of inspectors needed to maintain the program will again experience a sharp decline.

Consideration is being given to requiring an annual vehicle inspection. If regulations were adopted that required annual inspections, the training program would necessarily require revision.

In addition to the Vehicle Inspector Training Program, the Division also administers a Fleet Operator Training Program. This program is designed to assist private companies with inspecting their own light duty trucks. Most companies owning a minimum of 100 light duty trucks are required to perform regular inspections on the vehicles. The Division provides the in-plant inspectors with 24 hours of classroom training in basic inspection techniques. Over the last two years, eight classes have been held, with an estimated six to seven persons attending each session.

Beginning in July, 1977, inspection will be required for all levels of such vehicles. This regulation will have a significant impact upon this training program. The Division estimates that class enrollment for training sessions will most likely reach from forty to fifty persons per session.

The State of Oregon is also participating in an Emission Control Program. A week-long workshop was held in the summer of 1977; the workshop served as a medium to train 25 community college instructors in emission control technique instruction. It is expected that these same instructors will develop similar training programs within their respective institutions.

In addition to the forementioned training programs, the Division also participates in other training efforts. Representatives from the Division have provided consultant and instructor services to community college journeyman level mechanic training, auto service industry clinic for mechanics, and the Oregon Council of Industrial Mechanics.

E. Career Potential

Career prospects within the air pollution control and abatement field in the State of Oregon appear to have stabilized. Limited growth is projected for the state and regional air pollution control agencies, and growth within the private sector appears to have stabilized. The air pollution control programs experienced major growth in 1971 in response to legislative revisions in the air quality control regulations. However, since that time programs have stabilized, with ensuing growth occurring in response to diversification of program activities rather than an expansion or addition of new program requirements. The state and regional agencies are not currently aware of any legislation or technology which would have a major impact upon program staffing; indeed, sources in the agencies indicated that no staff growth would result with the adoption of the Clear Air Amendments.

F. Conclusion

The career opportunities for all occupations within the air pollution control fields in the State of Oregon are reasonably stable. Nevertheless, while the workforce demands for personnel has somewhat stabilized as compared to the last five years, as a result of turnover within the programs there will be a continuing and growing demand for qualified personnel at all levels within the air pollution control field. It has been demonstrated that qualified professionals and technicians with experience in the pollution control field are at a premium.

II. NOISE

A. Introduction

Noise pollution control and abatement regulatory functions are vested with the Oregon Department of Environmental Quality. The Noise Section of the Air Quality Control Division has been delegated administrative authority for noise programs on a state level. The noise control enabling legislation was adopted in 1972; however, until 1974, no official noise control agency existed.

The Noise Control Regulations are specific in the activities to be administered by the Noise Section. Three activities were defined by the regulations:

1) to provide a coordinated statewide program of noise control to protect the health, safety, and welfare of Oregon citizens from the hazards and deterioration of the quality of life imposed by excessive noise emissions;

2) to facilitate cooperation among units of state and local governments in establishing and supporting noise control programs consistent with State program and to encourage the enforcement of viable local noise control regulations by the appropriate local jurisdiction;

3) to develop a program for the control of excessive noise sources which shall be undertaken in the progressive manner, and each of its objectives shall be accomplished by cooperation among all parties concerned.

In addition to these three activities, the Section indicated that it has also been assigned the following functions:

- bringing all known industrial and commercial noise sources into compliance with standards;
- reducing noise levels on roads by reducing noise levels on new motor vehicles;
- reducing the number of noisy vehicles in the Portland area;
- reducing ambient noise levels near racing facilities;
- reducing noise levels adjacent to new public roads;
- encouraging local noise control programs;
- reducing the noise due to buses in the Portland Transit Mall;
- conducting special noise studies, personnel education, and maintaining measuring equipment;

During the next five years, the Section anticipates expansion of a number of its program activities. The following program priorities have been defined for possible implementation during the coming three to five years:

- expansion of the local government technical assistance program to encourage the development and implementation of local noise ordinances;
- drafting and implementation of highway construction noise control regulations;
- drafting and implementation of race track/racing noise control regulations;
- conducting studies on noise levels and conditions associated with airports and air traffic patterns;
- expansion of the plan review (E.I.S.) process to include a formal permitting program prior to construction.

The eleven Regional Department of Environmental Quality Offices also have responsibilities under the noise control program. Two basic functions have been defined for these Offices:

- reduction of noise levels on private property resulting from the use of recreational motor vehicles;
- resolving citizens complaints including investigation of complaints, documenting violations of standards, and setting compliance schedules for sources found in violation.

The Oregon Department of Transportation administers a traffic noise control program. The basic function of this program is to evaluate highway projects, both new construction and upgrading, with regard to existing and projected noise burdens that will be generated by traffic. The Environmental Section of the Department performs noise evaluation to comply with the Federal Highway Administration noise regulations, measures ambient noise conditions near a proposed construction site, and estimates and analyzes traffic noise projections for five, ten, and twenty years. As traffic noise problems are identified, the Environmental Section will make recommendations to mitigate the problem.

B. Workforce Profile

The Noise Section of the Air Quality Control Division is staffed with four professional/technical positions and one clerical position. The four professional/technical positions include one engineer, one noise pollution supervisor, and two noise technicians. One of the noise technician positions is funded by the Comprehensive Employment and Training Act. Turnover within the Section has been minimal, with the exception of the C.E.T.A. position. The C.E.T.A. positions experience turnover on the average of every two years. This turnover is attributed to better job opportunities. As position vacancies occur, the Section sends a job description through the State Executive Department, Personnel Division. The Personnel Division is responsible for the active recruitment of new employees.

The Regional Department of Environmental Quality Office also perform noise control activities. Each regional office allocates a portion of one person-year to noise related activities. Most noise abatement activities are delegated to an environmental specialist. Turnover within the regional offices is considered to be low.

The Department of Transportation currently employs three engineers whose principal activities are in noise abatement and control. Each of the engineers has extensive experience in acoustics and sound. Turnover within the program has been minimal. The Department of Transportation, as the other state agencies, recruits through the State Executive Department, Personnel Division.

Municipal and private industry noise control programs are just beginning to emerge. There are currently five cities in Oregon with some type of noise ordinance. The following table depicts the type of noise ordinance administered by each city.

TABLE V

STATE OF OREGON

Municipal Noise Ordinances (1975)

City	Nuisance	Zoning	Vehicle	Aircraft	Building	Construction	Rec/ Vehicle
Coos Bay	0	-	0	-	-	0	-
Grants Pass	0	X	-	-	-	-	-
Medford	0	-	-	-	-	-	-
Portland	0	X	X	-	-	X	X
Silverton	-	X	-	-	-	-	-

Key: X - Regulations including acoustical criteria
0 - Regulations not including acoustical criteria

(Chart excerpted from Sound and Vibration, December, 1975. Clifford R. Bragdon, Contributing Editor.)

As noted in the above table, Portland has the most comprehensive municipal noise program. The municipal program is administered through the Bureau of Neighborhood Environment. The Noise Enforcement Section was created in 1973; however, the City of Portland did not adopt a comprehensive noise enforcement ordinance until 1976. The Bureau has two primary activities under the noise program: 1) direct enforcement of the noise ordinance and 2) study and survey of aerial noise problems within the city not currently being enforced. The Bureau currently employs three full-time persons under its noise program. The three persons have professional backgrounds in economics, urban studies, and psychology, and the Director is a psychoacoustician. Turnover in the department has been nil since the beginning of the program. However, the Department would recruit for staff through referrals and through local and national advertising.

Further information on the private sector workforce is limited. The Department of Environmental Quality estimates that there may be up to twenty persons actively involved in private consulting work in the noise field.

C. Workforce Projections

The Noise Section of the Air Quality Control Division expects its staff to double by 1982. During 1977, the Section has requested an additional engineering position. However, the Section is not totally optimistic about the possibilities of securing funding for the position. However, the Section indicated that between 1978 and 1981 there would be a distinct need for two to three engineers and an environmental technician. This staff increase will be needed as the Section expands its program operations to include the priorities outlined in the introduction.

The Noise Section also predicts some growth in the regional offices. Officials indicated that three part-time positions would be added to the regional offices during the 1977 to 1979 biennium. Further, these positions would likely be filled by persons with experience in engineering. Additional projections suggested that an engineer would be needed for the regional offices by 1981.

The Department of Transportation indicated that there was a need for expansion of the Noise component. In particular, the program is considering pursuing programs in mass transit, airport and airway noise control. During 1977, the Department has requested the approval of two additional positions: one engineer and one technician. They could not speculate on whether or not these positions would be approved. In addition they indicated that, if program options in mass transit and airport noise are pursued, two additional staff positions would be necessary. One position would require background and experience in mass transportation, and the other would be filled by a person with qualifications in aeronautical noise. While these positions would be desirable, the positions would be dependent entirely upon the availability of funding through the legislature.

The City of Portland Bureau of Neighborhood Environment does not predict any growth in its staff during the next five years. Any new activities acquired by the Bureau would be handled through realignment of staff functions.

Workforce projections for the private sector are difficult to determine. Any increase in the private sector workforce will be a consequence of expanded state and municipal enforcement activities. While such an expansion is planned, it would be premature to speculate on the impact of this effort on private sector workforce requirements.

D. Training and Certification

Due to the recent interest in environmental noise program, few professional or technical training programs for noise related occupations currently exist. In the past there was little demand for persons qualified in noise pollution control, as a consequence, professional and technical schools have not developed noise related training programs. However, with the emergence of board scale noise control programs there is a substantial need for development of both professional and technical training programs in the noise area.

The Noise Section of the Air Quality Control Division offers a basic orientation program for new employees which consists of an informal on the job sharing experience with seasoned employees. The Section also has a limited continuing education program for staff members. The Section encourages staff members to participate in available workshops and seminars; however, sources indicated that its locality participation in national conferences and training sessions was often prohibited due to the travel expense.

The Department of Transportation also has an informal new employee training program which consists basically of individual task instruction provided by more experienced employees. It supports staff participation in continuing education and upgrade training. However, due to fiscal limitation most training is provided through attendance at limited duration conferences and workshops. Travel expenses were also cited as a major obstacle to obtaining high quality training available at national conferences and training sessions.

E. Career Potential

The career potential for noise related occupations within the State of Oregon is growing stronger. During the past three to four years the state has experienced a rather significant increase in the demand for personnel with noise related experience and training. This trend is expected to continue through the next five years. Experts currently practicing in the noise field indicated that the number of persons with training in noise is limited, and that there are few training programs available to educate professionals and technicians.

The two state operated noise programs, the Department of Environmental Quality and the Department of Transportation, will experience growth during the next five to ten years. Both programs anticipate an expansion of enforcement activities as well as activity diversification. It is projected that there will be employment opportunities for both professional engineers and technicians within the state agencies' noise programs.

The private sector workforce requirements in the noise field are also expected to increase during the next five to ten years as the state agencies expand and diversify their enforcement activities; however, the extent of growth within the private sector can not be adequately assessed.

F. Conclusion

Three conclusions may be made following a review of noise program data for Oregon:

1) that while noise programs are just emerging within the state, there will be a continual growth in the demand for both professional and technical staff at all occupational levels within the noise abatement and control field;

2) that occupations and programs within the noise field will experience significant diversification as there is an expansion of enforcement activities into the mass transit and airport noise control and abatement field;

3) that technically oriented training programs for both professionals and technical personnel are at a premium.

The State of Oregon is proud of its noise program, and is optimistic about the future potential of the program. However, it is noteworthy that any future growth and diversification in the noise program is dependent upon the availability of funds. Consequently, the projections will be tempered by both the availability of funds and the state's political climate.

III. PESTICIDES

A. Introduction

Control and regulation of pesticides in the state is vested with the Oregon State Department of Agriculture. The Plant Division within the Department has administrative responsibility for pesticide related programs. It has six basic operational goals:

1) inspecting of Oregon-produced plant materials at all growing nurseries and sales locations in the state;
2) inspecting of nursery stock entering Oregon produced in other states;
3) developing, establishing and carrying out statistically sound systems for sampling pesticides, feeds, fertilizers, and agricultural minerals and lime;
4) training, certifying, and licensing 5,000 to 10,000 pesticide applicators in Oregon;
5) increasing plant pest and disease survey and detection efforts in the major crop areas of Oregon agriculture;
6) developing an insect and plant disease rating system for use in determining the type of action to be taken on any introduced or new plant pest.

Within Oregon, licensure of commercial applicators was required previous to the Federal Environmental Pesticide Control Act. In order to secure a license, an applicator was required to pass a qualifying examination. Upon passage of FEPCA, the Division requested a waiver of examination requirements for previously licensed commercial applicators. The Environmental Protection Agency reviewed the examination content and determined that with the exception of the areas of law and safety the examination was in compliance with legislative mandates. In an effort to upgrade the commercial operators' knowledge of legislative regulations and safety procedures, the Division sent self-evaluation to each commercial applicator, and requested that the examination be completed and returned to the Division. As a consequence of the Division efforts, all commercial applicators that were licensed prior to the passage of FEPCA, were "grandfathered" into the certification program. However, upon re-licensing, the commercial applicators will be required to pass the standardized examination.

The Plant Division cooperates with Oregon State University Extension Office in the training of pesticide applicators, and particularly private applicators. The Extension service has been actively involved with community pesticide education since 1955. In addition to its ongoing effort in private applicator training, the Extension Office has a continuing program in pesticide upgrade education.

B. Workforce Profile

The Plant Division is currently staffed with a total of 31 positions: 3 clerical positions, 1 technical position and 27 professional positions. In addition to the 31 full-time positions, a team of 6 summer aides provides staff support to the Division. The following table provides a breakdown of the staff by occupational type.

TABLE VI

OREGON DEPARTMENT OF AGRICULTURE

Plant Division
Current (1976) Staffing Level

Position	1976
Entomologist	5
Plant Pathologist	3
Agronomist	7
Inspector	8
Supervisor	4
Other	4
TOTAL	31

The Other category includes the three clerical positions and the one laboratory assistant. Turnover for the Division averages approximately 6% annually. During the last two years, the Division has lost four employees: two retired and two resigned. The highest turnover is in the laboratory assistant category. The laboratory assistant is classified as a low level entry position; therefore, many degreed professionals will accept a position as a laboratory assistant to acquire merit ranking. As higher level positions become available, the laboratory assistant will apply for and generally be promoted to higher level positions.

The Division recruits through the State Executive Department, Personnel Division. While the State Executive Department is the lead agency for the recruitment activities, the Plant Division actively assists with advertising the position. The Division sends employment notices to various agencies and institutions with related programs.

The Laboratory Services Section of the Department of Agriculture provides technical support services to the Plant Division. The primary function of the Laboratory is to analyze products for conformance with the truth in labeling regulations. Specific to the Plant Division, the Laboratories perform analyses on pesticides, pesticide formulations, pesticide residues, and plant foods.

The Laboratory Services is currently staffed with 19 persons: 14 professional, 4 technical, and 1 clerical position. The following table provides a breakdown of the staff by occupational type.

TABLE VII

OREGON DEPARTMENT OF AGRICULTURE

Laboratory Services
Current (1976) Staffing Level

Position	1976
Administrator	3
Chemist	6
Microbiologist	5
Laboratory Assistant	2
Laboratory Technician	2
Clerical	1
TOTAL	19

Turnover within the professional category is stable; however, turnover in the laboratory assistant category is approximately 100% annually. This extraordinary high turnover is related to the low salary and the menial nature of the work. Recruitment for position vacancies is handled through the State Executive Department, Personnel Division.

The Oregon State University Extension Office is, as previously stated, responsible for coordination of the coordination of pesticide applicator training. One part-time person, the Extension Entomologist and Pesticide Coordinator, has responsibility for organization of the programs. There is an additional four persons who provide administrative and clerical support to the project: 1 entomologist, 1 graduate student in entomology, and 2 secretaries. The six State pesticide specialists provide support for instruction of commercial applicators. The background and of the specialists includes: 2 entomologists, 1 agronomist, 2 plant pathologists, and 1 agricultural chemist. The county and area extension offices are also involved with the local coordination and operation of the private applicator training programs through 38 local and four area offices. A cursory review of the county and area offices revealed that, in addition to the four area supervisors, an estimated 78 county staff members were involved in some aspect of the pesticide training. And, it was estimated that a maximum of 5% of their time during 1976 was allocated to pesticide training activities which is equivalent to 3.9 person years.

Estimates on the number of persons in the private sector workforce involved with pesticide programs were obtained through the Department of Agriculture and the Extension Office. From available data, it appears there are from 250 to 300 commercial pesticide applicator firms in the state. It has been estimated that these firms are owned by about 300 persons employing an estimated 1,200 to 2,000 applicators. The figures further suggest that there are 3,000 licensed pesticide consultants in the state and 28,000 to 30,000 farmers in the state who apply pesticides. Another segment of the pesticide related workforce are the public applicators, employed by state operated programs, who are involved in right-of-way spraying, institutional pesticide application, and research and development in application procedures. The Department of Agriculture estimates that there are 1,000 persons presently involved in those aspects of pesticide research and application.

C. Workforce Projections

The Plant Division of the Department of Agriculture anticipates an average annual growth rate of 10% per annum. This growth is correlated with the expected increase in the demand for staff services required for meeting existing legislative mandates. There is no planned expansion or diversification of services. Further, the Division is not currently aware of any emerging legislation or technology which would have an appreciable impact upon staffing requirements. The following table represents the anticipated staff requirements based upon the 10% per annum growth rate.

TABLE VIII

OREGON DEPARTMENT OF AGRICULTURE

Plant Division
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Entomologist	5	6	7	7	8	9	n/a	13%
Plant Pathologist	3	3	3	4	4	4	n/a	7%
Agronomist	7	8	9	9	10	11	n/a	10%
Inspector	8	9	10	11	12	13	n/a	10%
Supervisor	4	4	4	5	6	7	n/a	12%
Other	4	4	4	5	5	6	n/a	9%
TOTAL	31	34	37	41	45	50	6%	10%

The Department of Agriculture Laboratory Services Division also predicts an average annual growth of approximately 10%. This growth will be concentrated in the technical positions. This growth will be a result of the anticipated sampling and analysis activities. The following table represents this growth configuration.

TABLE IX

OREGON DEPARTMENT OF AGRICULTURE

Laboratory Services
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Administrator	3	3	3	3	3	3	n/a	0%
Chemist	6	6	6	6	6	6	n/a	0%
Microbiologist	5	5	5	5	5	5	n/a	0%
Laboratory Assistant	2	2	2	3	3	3	n/a	10%
Laboratory Technician	2	2	2	3	3	3	n/a	10%
Clerical	1	1	1	1	1	1	n/a	0%
TOTAL	19	19	19	21	21	21	n/a	10%

The status of staffing for the Pesticide Applicator Training Program within the Oregon State University Extension Office during the next five years is in question. Sources have indicated that there is a need for a full-time coordinator for the program. The program coordinator is currently devoting half-time to this activity. If and when a full-time person will be assigned to this program is not known since such staff espansion will depend on the availability of federal funding. Existing plans call for the entomologist position and the student assistant position to be phased out within the next one to two years; however, the clerical support will be continued. It was further estimated that the staff effort provided by the county extension offices would likely remain stable through 1982.

Growth statistics are difficult to determine for the private sector. However, the Department of Agriculture conceded that there would be some growth in the number of commercial applicators during the coming five years; however, no estimate was made regarding growth levels. The Department based its projection upon two factors:

1) the steady increase in the number of requests made of the Department for referrals of commercial applicators;
2) the trend toward the use of short-life pesticides.

Over the past three to four years, there has been a definite trend developing toward the use of short-life pesticides. In the past, there was a greater reliance upon such long-life pesticides as DDT. However, as the deleterious effects of these chemicals upon the environment have been reported, pesticide applicators have sought suitable short-life pesticide replacements. As the usage of short-life pesticides increases, a larger workforce will be required as the pesticides must be applied more frequently.

No other estimates or statistics are available on the growth or decline of workforce requirements within the private sector pesticide-related occupations.

D. Training and Certification

As previously noted, the Oregon State University Extension Office has been delegated the authority for coordination of pesticide applicator training. The 38 county extension offices are involved with coordinating and scheduling the local private applicator training as well as communicating with private applicators and assisting with the actual training activities. The county extension offices are, in general, utilized more effectively for the private applicator training.

The Extension Office has utilized a series of four thirty-minute videotapes in training of private applicators. The videotapes are aired by the Oregon Public Broadcasting Service. Applicators interested in participating in the training were required to register with the extension office. Upon registration, the applicator is sent copies of two training manuals: the Northeast Pesticide Certification Manual written at Cornell University and the U.S. Environmental Protection Agency Core Manual. Following the videotape broadcasts, the applicator attends a short training session where individual questions and problems can be discussed. Following the session, the licensing examination is conducted by Department of Agriculture representatives. During 1976-77, a total of 5,310 private applicators participated in this type of training. The training was offered in the Fall of 1976. A second series of videotape training programs are planned for the Fall and Winter of 1977. It is estimated that up to 4,000 more private applicators may be trained during the coming five years; however, the actual number of program participants will be greatly influenced by the pending pesticide restricted-use regulations.

The county extension offices have also prepared and conducted a series of private applicator short courses. The training is three hours in length and consists of a slide-tape presentation. This program was operational during the Fall and Winter of 1975. At that time, approximately 200 persons participated in the training.

The commercial applicator training is, most generally, coordinated through the central extension office located in Corvallis. The training programs are instructed by the six state pesticide specialists. It is expected that, in the near future, some of the instruction will be sub-contracted to highly specialized pesticide professionals.

Commercial applicator training is categorized according to the guidelines presented under the Federal Environmental Pesticide Control Act. The ten categories of commercial applicators used in Oregon are:

1) Agricultural Pest Control;
2) Forest Pest Control;
3) Ornamental and Turf Pest Control;
4) Seed Treatment;
5) Aquatic Pest Control;
6) Right-of-Way Pest Control;
7) Industrial, Institutional, Structural, and Health-Related Pest Control;
8) Public Health Pest Control;
9) Regulatory Pest Control;
10) Research and Development.

Commercial applicator training is scheduled at times and locations considered to be most propitious. The Extension Office indicated that it has trained 839 commercial applicators to date (April, 1977). Program officials estimated that there would be up to 1,000 more commercial applicator trained during the next year. By 1981, all 2,000 commercial applicators will be trained and certified. The Office could not provide figures on the number of applicators trained by category.

The Oregon Extension Office will be a primary means of keeping applicators up to date with changing technology and a continued suitable level of competency. In order to maintain a license, an applicator must participate in a minimum of 3 accredited short courses during a five year period. If the applicator fails to participate in such upgrade training, he/she will be required to retake the certification examination.

In addition to the actual pesticide applicator certification training programs, the Extension Office has offered pesticide upgrade training programs since 1955. Courses have been offered in agricultural plants, agricultural animals, vector control, and structural pest control. These courses and similar efforts will be continued throughout the next five years. These courses are offered on a semi-annual basis. The courses are offered in one location per year. The Office makes a concerted effort to vary the location annually.

The Division of the Department of Agriculture Plant has an informal new employee training program. The programs consists mainly of sharing work experiences with trained staff members. The Division encourages its staff members to participate in continuing education programming. Tuition grants are available to qualified staff members; an average of two persons receive tuition grants annually. Most of the continuing education courses taken involve either management/administrative training or science related courses.

E. Career Potential

Growth in the number of positions in pesticide related occupations for the state government has stabilized. The only projected growth for state pesticide activities is related to the average annual expansion in the requests for existing program services. The Plant Division and the Laboratory Services Program estimate an average annual growth of 10%. Withstanding isolated positions, turnover within the state agencies is also relatively stable, with a major share of the turnover directly related to retirement.

It is projected that there will be a substantial increase in the demand for commercial applicators during the next five years. This increase will be a consequence of the trend toward using short-life pesticides rather than long-life pesticides like DDT. The skills and knowledge bases required by commercial application occupations will continue to diversify as new technology and more sophisticated chemical pesticides are introduced onto the market.

F. Conclusion

Following a review of pesticide control activities in Oregon, the following conclusions can be made:

1) that the workforce requirements for the primary public agencies involved in pesticide control are expected to grow by only 10% annually, and that this growth is correlated with limited expansion in the request for existing program services;

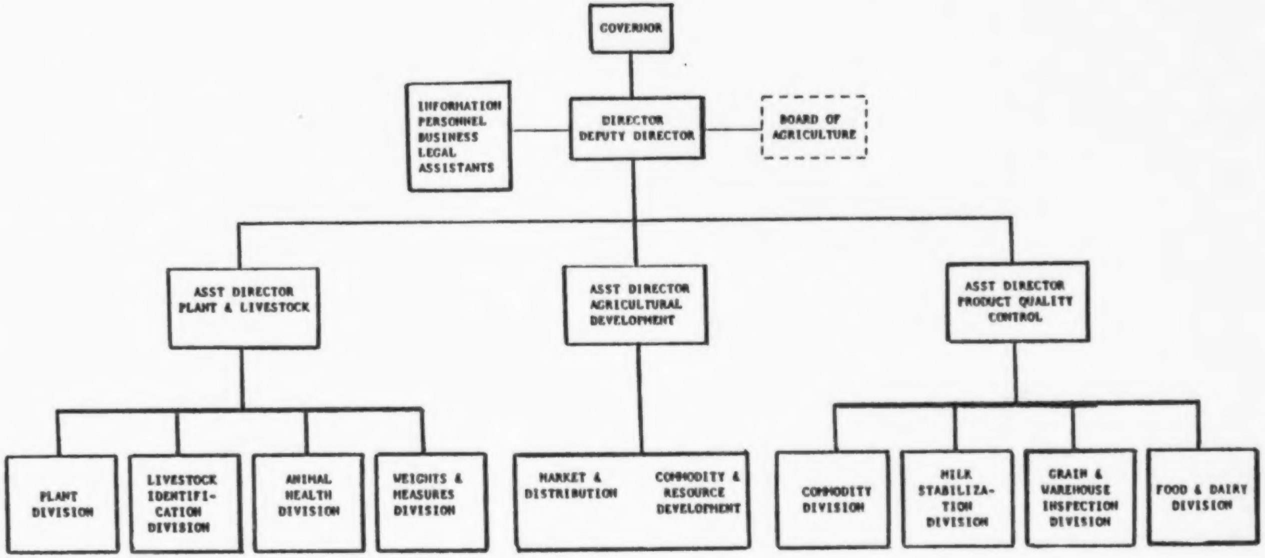
2) that the private sector pesticide related occupations will experience an undetermined amount of growth during the next five years, and that this growth is attributed to the usage of short-life pesticides and the marketing and use of more complex chemical pesticides.

The Department of Agriculture was not aware of any emerging legislation or technology which would have a significant impact upon either the state or private sector workforce profile. However, the Department added that the projections presented within this report are based solely upon the thesis that no additional programs would be legislated. If new federal or state legislation were introduced relevant to pesticide control, there would be a concurrent and somewhat significant impact upon the workforce projections.

FIGURE 1

STATE OF OREGON

DEPARTMENT OF AGRICULTURE
Organizational Chart


GOVERNOR
INFORMATION
PERSONNEL
BUSINESS
LEGAL
ASSISTANTS
DIRECTOR
DEPUTY DIRECTOR
BOARD OF AGRICULTURE
ASST DIRECTOR PLANT & LIVESTOCK
ASST DIRECTOR AGRICULTURAL DEVELOPMENT
ASST DIRECTOR PRODUCT QUALITY CONTROL
PLANT DIVISION
LIVESTOCK IDENTIFICATION DIVISION
ANIMAL HEALTH DIVISION
WEIGHTS & MEASURES DIVISION
MARKET & DISTRIBUTION
COMMODITY & RESOURCE DEVELOPMENT
COMMODITY DIVISION
MILK STABILIZATION DIVISION
GRAIN & WAREHOUSE INSPECTION DIVISION
FOOD & DAIRY DIVISION

IV. POTABLE WATER

A. Introduction

Prior to July 1, 1977 the Oregon Department of Human Resources, Office of Sanitation Services was the administrative agency for state water supply programs. Early in 1977, the Governor's Office recommended that the water supply program be phased out; as a consequence, no state monies were allocated for operation of the program.

The U.S. Environmental Protection Agency Region X Office indicated that it has made arrangements with the Portland Operations Office, a regional station of the U.S. EPA, to supervise ongoing water supply programs in the state. Nevertheless, the Regional Office is optimistic about restoring the water supply supervisory functions to the state within two years.

B. Workforce Profile

Due to the state of flux which currently exists within the Oregon Department of Human Resources, Office of Sanitation Services, information on the 1976 workforce profile for the Oregon Water Supply Program is not available.

The collection of information on the private sector water supply workforce was also hampered by the situation existing within the Office of Sanitation Services. The following table provides an estimate of the number of water supplies, the sources of supplies, and the population served.

TABLE X

STATE OF OREGON

Community Water Supplies (1976)

Sources of Supplies	Number of Supplies	Population served	Percent of Population
Surface	336	1,427,100	78%
Ground	356	279,000	15%
Mixed	35	127,000	7%
TOTAL	727	1,833,100	100%

Of the 727 community water supplies, 55 supplies serve 47 percent of the population of the state. In addition to the 727 community water supplies, there are over 2,400 other public water supply systems in the state. The only information which is maintained on these supplies is a file of names and locations, sources of supplies, and whether or not treatment is provided.

Sources in the state estimate that there are approximately 299 persons employed in water supply related activities in the state. The following table provides a breakdown of these employees by occupational type.

TABLE XI

STATE OF OREGON

Community Water Supplies
Current (1976) Staffing Level

Position	1976
Operator	199
Maintenance Worker	34
Mechanic	18
Other	56
TOTAL	299

The Other category includes 15 watershed tenders and 41 water meter installers. No information is available on the average annual turnover rate or recruitment procedures employed by these municipal facilities.

C. Workforce Projections

The U.S. EPA Region X Office indicated that eleven persons would be assigned responsibility for supervision of the Oregon Water Supply Program. There will be one coordinator (an engineer), one attorney, two secretaries, and a team of seven other professionals. The seven professionals will have a background in either engineering or physical/biological sciences. Five of the professionals will be located in Portland, and two will be situated in Seattle. As mentioned in the introduction to this section, the Regional Office is optimistic that Oregon will resume supervision of the potable water program by 1979. Consequently, the Regional Office did not make staffing projections past 1979.

All sources projected that there had be a prominent need for an increased workforce on the state level. Indeed, in a Region X evaluative report on Oregon's program, Oregon Water Supply Program Evaluation, the U.S. EPA recommended a three-fold increase in state staff. Therefore, if the state resumes supervision of the program, it may need to do so at an increased level of staffing. Nevertheless, until the state program is reinstituted, it is premature to speculate on future state agency workforce requirements.

During the next five years, the private sector workforce is also predicted to remain reasonably stable. Under the provisions of the Safe

Drinking Water Act, the number of non-community water supplies registered may experience a four- to five-fold increase. Nevertheless, sources indicated that it would have a limited impact on the private sector workforce.

D. Training and Certification

Oregon has a voluntary waterworks operator certification program. The program has been operable for more than twenty years. Since 1961, the state legislature has been investigating the possibility of requiring mandatory operator certification; however, such a revision has not received adequate legislative support. During the next five years, the prospects of changing the certification requirement do not appear bright.

The evaluation study performed by the Regional Office revealed that a much larger portion of the total population is served by systems with qualified operators. Of the water systems serving 5,000 persons or more, only seven systems were not operated by certified personnel. Nevertheless, of 650 water systems serving less than 5,000 persons, only 26 systems employed certified operators.

Several state post-secondary educational institutions participate in waterworks training. Oregon State University offers an annual short course for operators. Approximately 200 persons attend the three-day program.

Clackamus, Linn-Benton, and Umpqua Community Colleges offer operator training programs. An estimated 30 persons participate annually in the twelve week training program. Linn-Benton Community College also operates a mobile training laboratory. On a monthly basis, the mobile unit provides eight hour training sessions at Coos Bay, Tillamook, and Lincoln City. Bi-monthly training sessions are held at Medford and Redmond.

E. Career Potential

The career opportunities for public and private water supply programs in the state appear to have stabilized. Limited growth is projected for the private sector during the next five years.

The status of the state agency water supply program is currently in question. As of July 1, 1977, funds for the program are being cut from the state budget. The U.S. EPA Region X Office is preparing to assume limited responsibility for ongoing programs within the state. Until the status of the state program is finally resolved, no predictions can be made on career prospects for the next five years.

F. Conclusion

The status of the state water supply program is tenuous. During 1977, the Governor's Office made the determination that Oregon would not accept primacy under the Safe Drinking Water Act, and in doing so, state financial support for the ongoing water supply program was terminated. The U.S. EPA Region S Office proposes to assume temporary responsibility for the program; however, the Regional Office is hopeful of restoring the water supply program to the State of Oregon in the near future.

V. RADIATION

A. Introduction

The Radiation Control Service which is located within the Oregon Department of Human Resources is the primary environmental radiation and radiological health administrative agency within the state. The principal goal of the Service is to protect the public and occupational health against radiation injury, accident, or death. The Service which is considered as both a regulatory and statutory agency has been delegated authority for administration of the following program activities:

- sampling of air, water, and precursors to food for the presence of radiation or radioactive materials;
- inspection and monitoring of persons using radiation;
- monitoring the environment around Nuclear Regulatory Commission and Agreement State Licensees.

Under the state radiation equipment licensing program, Oregon has a regulatory licensing program for medical and industrial radiological X-ray programs. There are approximately 1,646 dental and 1,318 medical X-ray programs in the state. Further, there are an estimated 35 non-healing arts X-ray progrms. Under Oregon's Agreement State Licensing Program, there are 178 licensees. These are supplemented by the 22 NRC licensees. (Statistics taken from a report prepared for the U.S. Department of Health, Education, and Welfare, Report on State and Local Radiological Health Programs, October, 1976.)

The State of Oregon does not have a fully developed classification system for the Agreement State Licensees; however, the Service stated that approximately one-half of the licensees were industrial users and the remaining users were in the medical category. In most instances, the radioactive materials are contained in sealed sources. A majority of the industries use the radioactive materials for gauging activities. For example, a radioactive capsule may be imbedded in the wall of a pipe. Periodic monitoring of the level of radiation will indicate how quickly the wall of the pipe is eroding.

B. Workforce Profile

The Radiation Control Service is currently staffed with 20 positions: 15.5 professional/technical and 4.5 clerical positions. The following table depicts the alignment of staff by occupational type.

TABLE XII

OREGON DEPARTMENT OF HUMAN RESOURCES

Radiation Control Service
Current (1976) Staffing Level

Position	1976
Radiation Health Physicist	7
Radiation Chemist	5*
Radiation Specialist	2
Laboratory Technician	1
Other	6*
TOTAL	21

* Numbers have been rounded to the nearest whole number.

The Other category consists of one administrator of the Health Machine Registration Program and 4.5 clerical positions. Turnover within the Service varies according to occupational type. The highest turnover rate is in the clerical category, with an average of 25% per annum. The Service did not consider this abnormally high for the classification of worker. The radiation health physicists also experience a moderately high turnover rate, estimated at 14% per annum. This high rate is attributed to better job opportunities in the private sector. The Service did indicate, however, that salaries within the Service are becoming more competitive. Further, representatives of the Service stated that there is a general satisfaction with living conditions in the state, and that persons are hesitant to relocate.

As position vacancies occur, the Service recruits new employees through the State Employment Service. Jobs within the Service are listed under the Merit System.

Private sector workforce statistics for "radiation control" occupations are difficult to determine. However, the Radiation Control Service was able to provide a general estimate as to the activities within the state. The Service indicated that there were four types of industries that employed a major proportion of the radiation control specialists: industrial radiography programs, oil well logging, chemical producers, and fabric mills. It is projected that there may be as many as 1,000 persons employed in "radiation control" programs. A sizable proportion of these employees are engineers. Turnover within these industries is considered to be low.

The Energy Research and Dvelopment Administration (ERDA) conducted a workforce assessment in western states on Nuclear Related Technicians. The following information on the available nuclear related workforce was taken from the report on that study which is entitled An Analysis of Nuclear Related Technician Manpower in Western States (1975).

TABLE XIII

STATE OF OREGON

Nuclear Related Technician Workforce
Current Estimate (1976)

Job Title	1976
Production, Test or Research Reactor Operator	23
Radioisotope - Production Operator	3
Nuclear Power Plant Operator	29
Hot-Cell Technician	1
Nuclear Facility Equipment Operator	3
Nuclear Facility Maintenance Technician	20
Radiation Control Technician	21
Nuclear Facility Chemistry (Radiochemistry) Technician	16
Non-Destructive Testing Technician	65
Radiographer	75
Instrumentation and Control Techincian	14
X-ray Calibration Technician	3
Radiologic Technologist	225
Nuclear Medical Technologist	101
Special Procedures Technician	9
Radiation Therapy Technician	15
Radiopharmacist	1
Soils Evaluation Technician	149
Draftsman	22
Welding Technician	50
Electronic and Instrument Technician	16
Quality Control and/or Quality Assurance Specialist	32
Metallurgical Technician	16
Ceramic Technician	4
TOTAL	913

C. Workforce Projections

The Radiation Control Service anticipates minimal growth during the next five years. During 1977, the Service proposes to add an eighth health physicist to its radioactive materials health physicist team. At the same time, the Service proposes to eliminate the half-time position in the radiation chemist category. No other positions will be added until 1979, when an administrative assistant and another health physicist will be added to the staff. The following table illustrates the growth pattern for the Radiation Control Service through 1982.

TABLE XIV

OREGON DEPARTMENT OF HUMAN RESOURCES

Radiation Control Service
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth/ decline (average)
Radiation Health Physicist	7	8	8	9	9	9	14%	5%
Radiation Chemist	5*	4	4	4	4	4	0	-5%
Radiation Specialist	2	2	2	2	2	2	5%	0
Laboratory Technician	1	1	1	1	1	1	0	0
Other	6*	6*	6*	7*	7*	7*	n/a	3%
TOTAL	21	21	21	22	22	22	n/a	1%

*Numbers have been rounded to the nearest whole number.

TABLE XV

STATE OF OREGON

Nuclear Related Technician Workforce
Workforce Projection (1977)

Job Title	1977	%/annum growth
Production, Test or Research Reactor Operator	24	6%
Radioisotope - Production Operator	3	17%
Nuclear Power Plant Operator	31	7%
Hot-Cell Technician	1	0
Nuclear Facility Equipment Operator	4	6%
Nuclear Facility Maintenance Technician	20	8%
Radiation Control Technician	22	27%
Nuclear Facility Chemistry (Radiochemistry) Technician	16	11%
Non-Destructive Testing Technician	67	7%
Radiographer	81	6%
Instrumentation and Control Technician	15	15%
X-ray Calibration Technician	3	17%
Radiologic Technologist	241	6%
Nuclear Medical Technologist	118	16%
Special Procedures Technician	12	21%
Radiation Therapy Technician	18	26%
Radiopharmacist	1	n/a
Soils Evaluation Technician	162	9%
Draftsman	22	2%
Welding Technician	50	0
Electronic and Instrument Technician	17	7%
Quality Control and/or Quality Assurance Specialist	33	7%
Metallurgical Technician	17	4%
Ceramic Technician	5	19%
TOTAL	983	8%

During the past three years there has been an average estimated growth of 8% in the nuclear related technician workforce. If this trend continues, by 1981 there will be approximately 1338 persons employed in the nuclear related workforce in Oregon.

D. Training and Certification

The Radiation Control Service provides new employees with extensive on-the-job training. All new employees participate in an informal six month apprenticeship program. During the apprentice training, the new employee's activities are supervised and monitored by more experienced staff members. As needed, the new entrants will receive special training in technical procedures as well as departmental policies and programs.

The Radiation Control Service encourages staff members to participate in continuing education programs. The Service estimates that approximately 10% of each staff member's time is allocated to upgrade training annually. The major concentration of the training is upon quality assurance, quality control, and new instrumentation equipment and techniques. The Service rarely sends employees to Oak Ridge Associated University for training due to the travel distance. The Service does participate in other courses available through U.S. EPA, the Food and Drug Administration, and the Bureau of Radiation Health. The training programs available through these agencies are generally considered to be excellent.

E. Career Potential

The career opportunities for existing professionals and technical occupations in the radiation control field are considered by experts in the field to be strong. However, growth in the number of available positions within the Radiation Control Service has stabilized, and this trend is expected to continue. The Service does not anticipate an expansion of its environmental radiation control program.

Growth within the private sector will average from 3% to 5% annually. The most significant increase will be in the nuclear technician related disciplines. This anticipated growth is underscored by the fact that there are three nuclear power generating units planned for the state. As these units become operational, there will be an increasing demand for professional and technical personnel with experience and training in the radiation control field.

F. Conclusion

Three conclusions may be made following a review of the workforce projections for the radiation control program in the State of Oregon:

1) that the Oregon Radiation Control Service will experience limited staff growth during the next five years, and that there will be a limited expansion of the environmental radiation control program;

2) that private sector radiation control occupations have a relatively strong career potential, and that during the next five years, numerous career opportunities will be emerging in nuclear related occupations;

3) that there will be an increased interest in non-ionizing radiation research, and that this may have an impact upon radiation control surveillance and monitoring activities and consequently, the staffing configuration of radiation control programs.

Training programs in the radiation control disciplines are relatively scarce. Educational institutions have not extensively explored the possibility of offering training programs in health physics and radiation control. With the growth in this area, educational institutions might well review the feasibility of developing such programs.

VI. SOLID WASTE

A. Introduction

The Oregon Solid Waste Management Law designated the Oregon Department of Environmental Quality the state lead agency for administration of state of local solid waste management programs. The Law was specific as to the responsibilities of the Department. They are:

- to coordinate studies regarding solid waste management;
- to act as the state lead agency in solid waste matters;
- to provide technical assistance to local governmental units regarding solid waste matters;
- to issue regulations relating to solid waste storage, collection, and disposal;
- to regulate solid waste storage and disposal at the local level; and,
- to issue permits for solid waste disposal sites.

The Solid Waste Division of the Oregon Department of Environmental Quality has been delegated the administrative authority for solid waste management programs. To optimize the efficiency of the program in performance of its objectives, the Division has been organized into four functional units: the Recycling Unit, the Permit/Enforcement Unit, the Planning and Implementation Unit, and the Hazardous Waste Unit.

The Recycling Unit is consider a public information and technical assistance program. The Unit operates a recycling switchboard, distributes a recycling information newsletter, and conducts research on recycling markets. Upon request, Unit staff will present programs on the value, techniques, and efficiency of recycling. Staff members also provide technical assistance to persons and companies interested in operating a recycling program.

According to Oregon state law, all disposal sites require an operation permit. The Permit/Enforcement Unit administers the permit program. Under the program, the Unit has a two-fold responsibility: the statewide coordination of permit issuance and coordination of disposal site inspection and compliance activities.

The Hazardous Waste Unit has two primary functions:

1) supervision of the ongoing operation of a safe and effective hazardous waste management program;
2) identification and location of hazardous wastes which require special handling and/or storage.

The emphasis of the Unit's program has been the study of problems associated with disposal of pesticide containers and monitoring of the hazardous waste facility.

The Planning and Implementation Unit administers two functional programs: the regional-county plan review program and the grant-in-aid program for capital construction. The Solid Waste Management Law required each local governmental unit to prepare a solid waste management plan. The Solid Waste Division was further mandated to provide technical assistance to the governments in the design of these plans. The Division also has final approval of the plan strategies. There are only five governmental units with plans outstanding.

The State of Oregon has a Pollution Control Bond Fund. The fund provides grants to local governmental units for capital construction of Solid Waste Disposal Facilities. The Planning Unit reviews grant applications and makes awards under this program.

Aside from the solid waste programs administered through the Oregon Department of Environmental Quality, Oregon has a unique Beverage Containers Certification Law. The purpose of the law is to promote the use of reusable beverage containers of uniform design, and to facilitate the return of containers to manufacturers for reuse as a beverage container. The Oregon Liquor Control Commission was defined as the administrative authority for the Law. The Commission is responsible for the certification of beverage containers and of redemption centers. There are no redemption centers currently in operation within the state.

The Law bans certain types of beverage containers within the state: specifically, metal containers so designed and constructed that a part of the container is detachable in opening without the aid of a can opener.

The Oregon Liquor Control Commission was enthusiastic concerning the success of the program. Officials indicated that the most ardent enforcers of the law were the consumers. In most instances, where complaints are filed, the retailer is frequently unfamiliar with the regulations and hastens to make the necessary correction. Since the passage of the law in 1971, there were only five complaints, which have been litigated.

B. Workforce Profile

The Solid Waste Management Division is currently staffed with thirteen professional/technical positions and three clerical positions. A significant proportion of the staff have backgrounds in engineering, sanitation, or physical science. The following table illustrates the distribution of professionals by occupational type.

TABLE XVI

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Solid Waste Management Division
Current (1976) Staffing Level

Position	1976
Administrator	2
Environmental Specialist	4
Sanitarian	1
Researcher	1
Information Representative	2
Engineer	3
TOTAL	13

Turnover for the Division has been averaging approximately 10% per annum over the past three years, with the exception of the recycling program, where it has been high. This has been correlated with the low salary scales for the research and information representatives. However, the Division has had these three positions evaluated by the State Executive Department and preliminary results appear to support a substantial increase in salary for these positions. As with other state agencies, the Division recruits new employees through the State Executive Department, Personnel Division.

The nine Department of Environmental Quality Regional Offices provide administrative and technical support to the Solid Waste Management Division. During the fiscal biennium 1975-77, the regional offices allocated an estimated 5.3 person-years of effort to solid waste related activities. These positions are primarily environmental technicians and environmental specialists; however, some support is provided by a limited number of engineers.

The Laboratories and Research Division provide some support to the solid waste division; however, it is generally limited to chemical analysis.

The State Liquor Control Commission indicated that due to the success of the program, no one staff member devotes full-time effort to the Beverage Container Certification Program. The Commission noted that the local police were the primary enforcement agents; however, once again little effort is necessary in enforcing the law since the consumer has taken a prominent role in monitoring the sale of uncertified containers.

For purposes of assessing the solid wastes related workforce profile within Oregon, the program has been divided into four categories: landfills, hazardous wastes, collection systems, and resource recovery programs. There are 313 permitted disposal sites in the state. The most recent breakdown of these sites by classification was prepared in January of 1976. According to that classification analysis, there are 8 sludge lagoons, 1 storage area, 26 rural transfer stations, 2 processing facilities, 67 open burning dumps, 62 modified landfills, 92 industrial waste sites, and 11 demolition waste sites for a total of 269 operable sites. Between January 1976 and May 1977, the number of sites has grown from 269 to 313. Most of the growth has occurred in the modified landfill and industrial waste categories. Approximately 50% of the landfills are privately owned, with the remaining 50% publicly owned. It is noteworthy that while 50% of the sites are publicly owned, a total of 75% of the sites are privately operated.

No specific figures were available on the staffing of these facilities. The Solid Waste Management Division indicated that most of the landfills were located in rural areas and that staffing of the facilities was extemely limited. Approximately 10 of the landfills are staffed on a daily basis. Nevertheless, no specific information was available on the estimated crew size for the facilities.

There is one hazardous waste site located in Oregon. It is near Arlington, Oregon and is operated by Chem-Nuclear Services, Inc. of Portland. The site is currently staffed with three operators and one secretary. A supportive staff of three chemical engineers are located in Portland, and they are responsible for contracting and negotiating with service users.

Oregon does not have any operating resource recovery processing facilities. However, two facilities are currently under construction, and two facilities are in the engineering stage. One of the facilities under contruction is located in Union County and scheduled to go on line in six months. The facility will be staffed with one manager, three operators, and one billing clerk-secretary. The second facility, which is located within Lane County, will not be in operation for a year to a year and a half. No information is available on the proposed staffing of this facility. Nevertheless, this facility will be much larger than the Union County operation.

Little cumulative information exists on the collection systems within the state. With the exception of two to three municipal systems, all collection services are privately owned.

C. Workforce Projections

The Solid Waste Management Division does not predict any growth in staff during the next five years under it existing program activities. Any additional growth in staff will occur through federal grants. The Division indicated that the Resource Conservation and Recovery Act would likely have a significant impact upon the staffing of the department, and that federal funds would be made available to implement the program. However, the Division stated that it would be premature to speculate on staff increases as a consequence of RCRA, since the federal guidelines for administering the program have not been made available

The regional DEQ offices are proposing to increase the amount of staff effort devoted to solid waste activities from 5.3 to 11.7 person-years of effort. Primarily this represents a shift of program priorities on the part of the regional offices, since there will be limited growth in the staffing levels. The focus of the activities will be more fully directed to hazardous waste control.

The Laboratory and Research Division does not propose any increase in the amount of staff effort provided to the Division.

The State Liquor Control Commission indicated that there would be no increase in staff under the Beverage Container Certification Program. The Commission emphasized that the program is operating so efficiently that there is no need for expansion of staff commitment.

The Solid Waste Management Division indicated that there would likely be a decrease in the number of persons involved in landfill activities during the next five years. The state is making a concerted effort to decrease the state's dependence upon open dumps and modified landfills. As these facilities are phased out, there will be fewer persons involved in landfill programs. However, the Division hastened to add that there would be a consequent increase in the skill level of those persons who continue to work within the field.

There may be limited growth in the number of hazardous wastes sites during the next five years. Another company has submitted a permit application. Nevertheless, the site is considered to be controversial, and as a consequence, the future of the site is tenuous.

There will be substantial growth in the number of employees in the resource recovery field. As the four planned facilities begin operation during the next five years, there will be a need for up to 40 employees.

Growth within the collection system workforce will be limited. The Division indicated that all municipalities currently have adequate coverage of community waste collection needs.

D. Training and Certification

The State of Oregon offers an individualized sanitary landfill operator training program. Beginning in February, 1977, the Solid Waste Management Division contracted with a private consultant to provide operator training at individual landfill programs. During the three months of program operation, the consultant has provided training at 5 to 6 sites. The program will be functional through 1977. Continuation of the program will be dependent upon the availability of federal and local funds.

Prior to February, 1977, little had been done in the way of operator training. Between 1974 and 1975, a series of operator training programs were offered in numerous locations throughout the state. Approximately 150 persons participated in the program. The training was discontinued due to lack of funding.

The Solid Waste Management Division has a formalized, new-employee training program. During the first day on the job, the new employee is provided with a pack of information concerning the operation of the program. During the third week of employment, the new entrant will attend a half-day orientation session on the Department of Environmental Quality.

The Division offers a limited continuing education program for its staff members. Supervisory courses are available which provide administrators with information concerning management skills and techniques. Partial tuition grants are offered to qualified employees. The tuition grant will generally cover the cost of half of the tuition. One to two persons utilize these grants annually.

E. Career Potential

Career prospects for the solid waste management field have stabilized with the exception of resource recovery. The resource recovery programs will experience significant growth during the next five to ten years as a consequence of the Resource Conservation and Recovery Act. The exact impact of the Act on the staffing of the State Solid Waste Management Division cannot be determined. Nevertheless, experts in the field indicate that the impact will be significant.

Career potential and upgrade opportunities for the landfill workforce will be somewhat limited. As many of the modified landfills are phased out, there will be a decrease in the total number of persons involved in the field. There will, however, be diversification in the sill requirements of the operators as existing landfills are altered to allow them to handle other types of materials.

Career potential for individuals employed in collections systems are also considered to be extremely limited. There are no apparent emerging occupations within the field.

F. Conclusion

Oregon has a progressive solid waste management program. The Beverage Container Law is illustrative of the state's effort to eliminate unnecessary waste and litter. The Department of Environmental Quality also encourages recycling. The state operates a recycling switchboard and distributes on a regular basis a recycling information newsletter.

The Resource Conservation and Recovery Act will most likely have a major impact upon both the public and private sector workforce projections; however, it is too early to make any definitive projections on the specific impact of the law. It should be emphasized that any change in the state's workforce will be tied directly to the availability of federal funding for additional staff positions.

VII. WASTEWATER

A. Introduction

Oregon's first comprehensive water quality control laws were approved in 1938, and were substantially modified in 1961. Changes have been made with each succeeding legislative session, but in 1967 Oregon's water quality control laws were revised and significantly strengthened. Among the legislated changes are:

- The state's water pollution control policy was changed from one of primarily pollution abatement to pollution prevention and water quality enhancement.
- It was made unlawful for any wastes to be discharged to public waters without a permit from the State Sanitary Authority, the predecessor of the Department of Environmental Quality.
- A program of State Sewage Works Construction Grants was instituted to supplement the federal grant program to assist cities in financing construction of sewage treatment works.
- State tax credits were made available to industries to assist them in partially recovering costs of installing pollution control facilities.

In 1969, air and water quality control programs were removed from the State Board of Health and these functions were established in the newly created Department of Environmental Quality. In 1973, authority for controlling subsurface sewage disposal was removed from the Health Division to the Department of Environmental Quality. That same year, state water quality laws were modified to conform with the provisions of the Federal Water Pollution Control Act Amendments of 1972. The department entered into an agreement with

U.S. EPA to issue waste discharge permits under the National Pollution Discharge Elimination System (NPDES).

The Water Quality Division, located in the Department of Environmental Quality, has responsibility for wastewater control and abatement programs for the State of Oregon. The division has administrative authority for the following program activities:

- establishing water quality standards, treatment requirements, and discharge limits to assure and protect legitimate, beneficial uses;
- issuing waste discharge permits to cities and industries specifying allowable discharges and incorporating implementation schedules if present treatment and control facilities are not adequate;
- promoting installation of public sewer systems and fully adequate sewage treatment plants in cities, districts, and unincorporated urban areas, and approved waste treatment and control facilities for industries;
- processing applications for federal and state sewage works construction grants and reviewing and approving plans and specifications for all sewage and waste disposal construction projects;
- conducting comprehensive stream surveys to determine sources and extent of pollution and monitoring pollution control projects;
- training waste treatment plant operators and sewage works personnel;
- collecting basic data regarding the physical, chemical, bacteriological and biological quality of certain ground and surface waters;
- investigating complaints, holding public hearings, and enforcing state water pollution control laws, regulations, and permit conditions;
- instituting civil penalty actions and other legal proceedings as necessary.

One primary program priority of the division is to develop a data base on non-point sources. This activity would include an assessment of associated problems.

For purposes of program operation, the division has been organized into three sections: Water Pollution Control, Municipal Sewage Works Construction, and Planning. The Water Pollution Control Section is responsible for control of point source permitting. Reviewing and approving plans for construction and administration of municipal construction grants is under the jurisdiction of the Municipal Sewage Works Construction Section. The Planning Section is involved with writing and updating the river basin plans and 208 Planning.

B. Workforce Profile

The Water Quality Division has 35 authorized positions: 27 professionals, 1 technician, and 7 secretaries. The following table depicts the distribution of professional and technical staff by occupation.

TABLE XVII

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Water Quality Division
Current (1976) Staffing Level

Position	1976
Engineer	19
Environmental Specialist	5
Water Quality Analyst	1
Sanitarian	3
TOTAL	28

The average turnover rate for the division is not available; however, it is estimated that the annual turnover rate for DEQ is approximately 30 percent. Sources indicated that the division's average turnover rate would be somewhat comparable. As position vacancies occur, the division utilizes the State Civil Service System to recruit personnel.

The nine Department of Environmental Quality Regional Offices, which have a cumulative staffing level of 88 persons, provide support to the division in wastewater programs. It is estimated that the regional offices currently allocate 30.7 person-years of effort to the Water Pollution Control Program and 21.2 person-years of the Subsurface Sewage Program. (For more information on the regional offices refer to the Air Program, Workforce Profile Section.)

Four regional 208 Planning grants were awarded to Councils of Governments. The grant recipients are:

1) Columbia Region Association of Governments, Portland;
2) Mid-Willamette Valley Council of Governments, Salem;
3) Lane Council of Governments, Eugene;
4) Rogue Valley Council of Governments, Medford.

All four agencies were funded in 1975 and continued program operation is planned through late 1977. Staffing information on these four agencies was collected for the 208 Planning effort. A total of 15-plus persons are assigned full-time responsibility for these activities. The following table provides an analysis of these staff positions by occupational type.

TABLE XVIII

STATE OF OREGON

Section 208 Planning Agencies Current (1976) Staffing Level

Position	1976
Engineer	5
Planner	5
Other	6*
TOTAL	16

*Rounded to the nearest whole number.

The Other category includes a planning aide, attorney, management analyst, drafting aide, and two scientists. Fractions of an attorney's and communications specialist's effort are used to support the activities of regular staff time at the Columbia Region Association of Governments. Turnover for the staffs is difficult to determine; however, most sources indicated that attrition was relatively stable. The agencies employ diverse recruitment methods that include advertising in newspapers and professional journals, interviewing candidates at colleges and universities, and registering with the state employment service.

The local agencies have made subcontract awards to other municipal agencies. The agencies estimate that approximately 41 persons are involved with 208 Planning through these subcontracts. These positions represent varied professional skills including engineering, planning soil science, hydrology, and fiscal management.

The Water Quality Division has a 208 Planning program. Five members of the division's staff are contributing time to the program. The five persons include two program executives (generalists), one engineer, one environmental specialist, and one secretary. (These persons were included in the division's workforce profile.) The basic thrust of the state's effort has been on non-point source pollution planning and control. The Regional Offices provide some support to the division, but theirs is basically a coordination function. The Laboratories and Research Division also provides support to the division in 208 Planning. Two program biologists provide a variety of laboratory analysis services.

Information of the private sector workforce in Oregon is somewhat limited. The division indicated that there are approximately 300 municipal treatment plants with NPDES permits and 66 municipalities with State Water Pollution Control Facility Permits. Sources within the division estimate that between 650 and 700 persons are employed in various wastewater related occupations within these facilities. No breakdown is currently available on estimated crew size or crew composition for each type of treatment facility.

The division reported that there are 431 industrial NPDES permits and 88 industries with State Water Pollution Control Facility Permits. A significant proportion of these industries specialize in wood processing or wood products. No estimate is currently available on the number of persons employed in the industrial facilities.

The State of Oregon permits a third type of treatment facility, agriculturally-related facilities which include fish hatcheries, dairies, and feedlots. Under this category there are currently 65 NPDES permits, and 9 State Permits. Again, workforce information is not presently available for this category of facility.

C. Workforce Projections

The Water Quality Division does not project any growth in staffing over the next five years. The division indicated that this stabilization was a consequence of the lack of state funding support. The 208 Planning effort will continue but the activities will be shifted from the temporary planning staff to the currently authorized, permanent staff.

The regional offices predict a decrease in the percentage of staff time allocated to both water pollution control and subsurface sewage. During the 1975-77 biennium, the offices allocated 39.4 percent of their total staff effort to water pollution control and 27.2 percent to subsurface sewage. During the 1977-79 fiscal biennium, staff effort for water pollution control is estimated at 32.6 percent and subsurface sewage at 26.7 percent. This translates into 48.4 person-years of support.

Two of the regional planning agencies are optimistic about the continued operation of their 208 programs. The Columbia Region Association of Governments and the Mid-Willamette Valley Council of Governments are presently planning to continue their 208 programs at a somewhat reduced level of staffing. The Lane Council of Governments and the Rogue Valley Council of Governments are somewhat indecisive about the future of their 208 Planning efforts and predicted that their programs may be phased out by the end of 1977 or early 1978.

Growth within the municipal treatment plants has stabilized. No major increase is expected in the number of operators during the next five years. Each year from two to four municipal facilities undergo a consolidation process. This program is an attempt to provide more service to a greater number or persons at a lower cost and greater efficiency. Consequently, while there is a planned expansion of service, the number of persons need to operate the facilities is projected to remain fairly constant.

D. Training and Certification

A voluntary wastewater works operators certification program was developed and implemented in 1956. During 1976, major revisions were made in the program to realigning it more closely with the National Association of Boards of Certification, and sources within the division indicated that additional changes will be made in the program during 1977-78. The current program is conducted in conjunction with training programs such as college courses in the field of engineering, chemistry, or allied science and other allied fields of endeavor such as short schools, correspondence courses, trade schools, community colleges, workshops, and seminars.

Five principal objectives have been defined for the program which include:

1) to improve the caliber of wastewater works operation and thereby assure the best protection of the State's water resources and maximum returns from the public investment in treatment works;

2) to help the operator create a pride in the work and stimulate a desire for self-improvement;

3) to provide the operator with a statement of proficiency which will be useful to the current position or as a reference to a prospective employer;

4) to help create or improve the confidence and respect of the public in the competence of the wastewater works employees;

5) to identify a reservoir of competent, well-qualified operators.

Certification examinations are given bi-annually in each of five areas: Portland, Eugene,Roseburg, Bend, and Pendleton.

The certification training programs are offered by the division in cooperation with Oregon State University. The University, which is located in Corvallis, provides the program facilities, and the division is responsible for the instruction and coordination. The annual short course training is offered for three days, an equivalent of 30 hours of classroom instruction. Annual attendance is estimated at 240 persons. Training for beginning, intermediate, and advanced operators was originally conducted in the short course; however, as the demand for the program increased and the amount of available space remained constant, the advanced training program was separated from the regular short course training.

Two community colleges, Linn-Benton Community College and Clackamas Community College, offer two-year associate degrees in water and wastewater technology program. It has been estimated that each of these colleges graduate approximately 30 students per year. These two colleges also conduct in-service training for an indeterminate number of wastewater works operators.

The division provides technical assistance to municipal treatment plants in the organization of individual plant in-service training. One division staff member allocates approximately 50% of his time to on-site training. This training frequently emphasizes laboratory techniques, treatment process, and treatment control.

The division indicated that, relatively speaking, the types of training programs currently being offered within the state are well attended and strongly supported by the municipalities. As a consequence, the division does not foresee the need for implementation of a mandatory operator certification program. Therefore, it is highly unlikely that a mandatory program would be implemented during the next five years.

E. Career Potential

Available job opportunities in the wastewater pollution control field has stabilized in both the public and private sectors. It is highly unlikely that the Water Quality Division will experience any dramatic growth trends during the next five years. In addition, sources indicated that if new legislation were introduced which required state action, the divison would make every attempt to reorganize existing staff efforts to consolidate any new program activities and requirements.

As with the state agency, the municipal treatment plants are making every effort to provide more and better service to their constituents through consolidating smaller facilities. This method is believed to be the most efficient and cost effective. Through use of this procedure, a minimum number of new employees will be required. Nevertheless, the state believes that the competency and skills of the existing operators will continue to be upgraded. The state plans to accomplish this goal through continued technical assistance and in-service training at the individual plants.

F. Conclusion

The wastewater related staffing requirements for the State of Oregon have, in brief, stabilized. No major growth for either the public or private sector is projected for the next five years. In essence, the state is implementing a policy of consolidating efforts and reorganization of program priorities to accomodate any new or emerging program requirements.

VIII. ENERGY

A. Introduction

In the past energy has been abundant and relatively inexpensive for the State of Oregon. However, this situation is rapidly becoming history as the energy shortages of the 1970s have demonstrated both the state's dependence upon energy and the finite nature of the state's energy resources. In response to the emerging need for a comprehensive energy agency to coordinate a broad spectrum of energy related programs, the Oregon Department of Energy was created in 1975. This Department assumed part, if not all, of the responsibilities previously assigned to the Nuclear Thermal Energy Council, the State Engineer, the Governor's Energy Allocation and Conservation Office, and the State Water Resources Board.

The Department of Energy has been delegated the following responsibilities:

- provision of staff for the Energy Facility Siting Council;
- preparation of independent forecasts on all energy;
- implementation of conservation and education programs;
- coordination for energy research and development efforts; and
- development of state contingency plans.

The Department has three major program areas: Siting and Regulation, Energy Planning, and Energy Efficiency and Resource Development. Staff responsibilities are aligned according to these program priorities.

The Siting and Regulation Program consists of the siting, monitoring and regulation of energy facilities which include: nuclear, geothermal and coal-fired power plants, research reactors, combustion turbines, electric transmission lines, pipelines carrying fuel or geothermal energy and hydroelectric projects.

The Planning Section of the Department of Energy has five broad based areas of responsibility: energy demand forecasting, economic cost-benefit analysis of conventional energy sources and facilities, analysis of the impact of conservation and nonconventional supply alternatives on the supply system, examination of energy end-use patterns, economic analysis of Public Utility District applications and development of an energy contingency plan.

Major goals of the Energy Efficiency and Resource Development Program include: preparation of a State Energy Conservation Plan, improved energy efficiency in state government, and promotion of increased energy efficiency in the residential sector through effective public education projects. Components of the Energy Efficiency Program are:

1) a state conservation program which includes promotion of: transportation alternatives, development of a computerized energy audit system to improve feedback to agencies, and better communication with agencies on energy saving ideas;
2) a State Energy Information Center which provides energy related information to the public.

The research and development efforts of the Department have involved inventorying and monitoring research projects, facilitating and coordinating various research efforts, participating in the formulation of federal energy research plans, and other similar activities.

The Department has developed a series of program priorities for the next program biennium which include the following highlights:

1) implementation of a State Conservation Plan with emphasis upon transporation energy use, recycling programs, building energy analysis, thermal energy efficiency ratings, and insulation loan programs;

2) research of alternative energy sources and more efficient energy utilization patterns; areas of possible research interest include solar energy for space and water heating, solar energy in agricultural and industrial process heat application, and generation of electricity from steam;

3) monitoring of the critical plant effluents at the Trojan Nuclear Plant and monitoring of construction and future operation of the Broadman Coal Plant and the Pebble Springs Nuclear Power Facility.

In essence, the major emphasis of the Department for the next two years will focus on assessments of the potential in Oregon for geothermal, solar, wind and other less conventional energy resources. The Department will work with universities and utilities to encourage the application of alternative energy forms that have potential.

The Department of Energy has recently published the First Annual Report on Oregon's Energy Future (1977). Chapters of the report abstract the state's status with regard to energy consumption and energy resources. While portions of the information contained in the report are not directly related to energy/environmental workforce statistics, it is valuable in charting the state's future energy situation. Chapters II and III of the report are included as an appendix to this section of the study.

B. Workforce Profile

At its creation in 1975, the Department of Energy was staffed with 26 positions. During the past two years, the Department has grown to 30 staff members: 25 professional/technical positions, 4 clerical positions, and 1 temporary student worker. The following table provides a review of the staffing configuration by occupation type.

TABLE XIX

OREGON DEPARTMENT OF ENERGY

Current (1976) Staffing Level

Position	1976
Administrator	8
National Resource Representative	3
Research Specialist	4
Engineer	7
Planner	1
Other	7
TOTAL	30

The Other category consists of 1 environmental specialist, 1 student worker, 1 information specialist, and 4 clerical positions.

Turnover within the Department of Energy has been high during the past two years; however, no specific percentage figures were available. The high rate of turnover has been correlated with the recency of program development. The Department indicated that it expected the rate of turnover to stabilize within the next two to three years as the program becomes more structured. As position vacancies become available, the Department refers the information to the Personnel Division of the

State Executive Department. The Department is not involved with any direct recruitment activities.

The Energy Policy Review Committee, a supportive policy body for the Department of Energy, was also created in 1975. The committee is staffed by nine members: three Governor's appointees, three House appointees, and three Senate appointees. The functions of the committee include:

- to determine compliance with State energy policy by Oregon agencies;
- to recommend conservation programs;
- to review contingency plans;
- to comment on forecasts; and,
- to advise on research and development.

Current private sector workforce projections are unavailabe. Most utility companies in Oregon have environmental components. In general, the utility companies have three basic programs: planning, air pollution control and abatement, and wastewater control. Portland General Electric Company is a fairly representative example of a functional environmental department. The Portland General Electric Company Department of Environmental Services has the following responsibilities;

- advising on environmental matters including responsibilities and laws;
- serving as a liaison with all environmental organizations and agencies;
- preparation of permit actions of an environmental nature;
- preparation of all environmental reports and statements;

- participation in rule making, hearings, and negotiations with environmental agencies and bodies;
- administering environmental monitoring programs including meteorological, radiological, ecological, and demographic programs;
- administering contract research in environmental fields;
- participation in pollution control selection;
- participation in site selection;
- providing advice on environmental aspects of construction;
- participation on industrial and public committees;
- conducting public presentations on environmental aspects;
- testifying before legislative and regulatory bodies.

The Department of Environmental Services is staff with twelve persons. All twelve positions are considered as either professional or technical. The following table provides a breakdown of occupations by positions.

TABLE XX

PORTLAND GENERAL ELECTRIC COMPANY

Department of Environmental Services
Current (1976) Staffing Level

Position	1976
Administrator	1
Biologist	5
Meteorologist	1
Ecologist	1
Air and Noise Specialist	1
Health Physicist	1
Geographer	1
Radiation Technician	1
TOTAL	12

A position for a secretary is funded, however, it is currently vacant.

In addition to the staff of the Department of Environmental Services, it is projected that there are 20 to 25 persons within the facility who are directly connected with environmental pollution control. Approximately two-thirds of these positions are in the technical category, and an estimated one-third is composed of chemists, health physicists, and engineers.

Turnover within the Department of Environmental Services has been minimal, with only one person leaving the Department during the past five years to return to school. As position vacancies occur within the Department, the administration makes a concerted effort to fill the position internally. However, when this is not possible, the Department will advertise the position in professional journals and local newspapers. On occasion, the Department will recruit through local universities.

The Portland General Electric Company is the owner/operator of the single nuclear power generating facility in Oregon, the Trojan Nuclear Plant. The Trojan Plant is located in Prescott and has a generating capacity of 1,130,000 net kilowatts. Portland Electric has two additional nuclear power generating units planned: Pebble Springs Nuclear Plant, Units 1 and 2. These two units will be located at Arlington, and will have a generating capacity of 1,260,000 net kilowatts each. Unit 1 is scheduled for operation in 1983, and Unit 2 is projected for completion in 1986. With the implementation of these two units, the environmental component of the Company will necessarily expand. However, no specific details are available on the projected staff requirements.

C. Workforce Projections

Workforce projections for the Oregon Department of Energy were not available through 1982. The Department was hesitant to make any estimates due to the recency of program implementation. However, the Department was able to provide information on the number and type of positions requested for the Department for the next fiscal biennium. The following table illustrates the staffing requirements through 1979.

TABLE XXI

OREGON DEPARTMENT OF ENERGY

Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth/ decline (average)
Administrator	8	12	12	12	*	*	n/a	16%
National Resource Representative	3	3	3	3	*	*	n/a	0
Research Specialist	4	5	5	5	*	*	n/a	7%
Engineer	7	10	10	10	*	*	n/a	14%
Planner	1	1	1	1	*	*	n/a	0
Other	7	12	12	12	*	*	n/a	16%
TOTAL	30	43	43	43	*	*	n/a	12%

* The Oregon Department of Energy was unable to provide growth/decline estimates for 1980 and 1981. Consequently, the %/annum growth/decline rate was calculated on a three year cycle instead of five years.

The growth in the Other category includes three student workers and one Inter-Personnel Agreement position. The information specialist position will be phased out in 1977.

No estimates are available on the amount of growth in energy related occupations in the private sector. The Portland General Electric Company Department of Environmental Services was unable to make workforce requirement projections for the next five years as a result of a recent departmental reorganization.

D. Training and Certification

The Department of Energy does not offer either new employee training or continuing education training for its employees. The Department indicated an interest in pursuing continuing education training during the next five years, but demonstrated no interest in new employee training due to the small size of the department.

There are no certification programs either currently operational or planned for personnel in energy-related environmental fields.

E. Career Potential

With the limited availability of information concerning the energy conservation and conversion programs in the state, it would be infeasible to offer trends for career potential. However, giving consideration to the emerging national energy shortage, it is practical to assume that there may be a considerable increase in the demand for all personnel levels with experience in energy conservation and conversion.

F. Conclusion

Since 1975, the State of Oregon has been actively exploring internal solutions to the emerging energy-related problems. The State Department of Energy has been involved in research and development, conservation and planning measures, and public awareness programs, with the goal of abating the possible consequence of a major energy crisis in the state.

The Department has developed a comprehensive energy program and is optimistic about the probability of total program implementation and citizen response.

Employment opportunities in the energy/environmental field in the state appear to be just emerging. The construction of the two planned nuclear facilities will have a major impact upon energy-related employment opportunities within the state. This increase may provide employment opportunities in all levels of environmental/energy disciplines. However, at this time, no projections can be made on the total impact of this expansion upon the state's workforce.

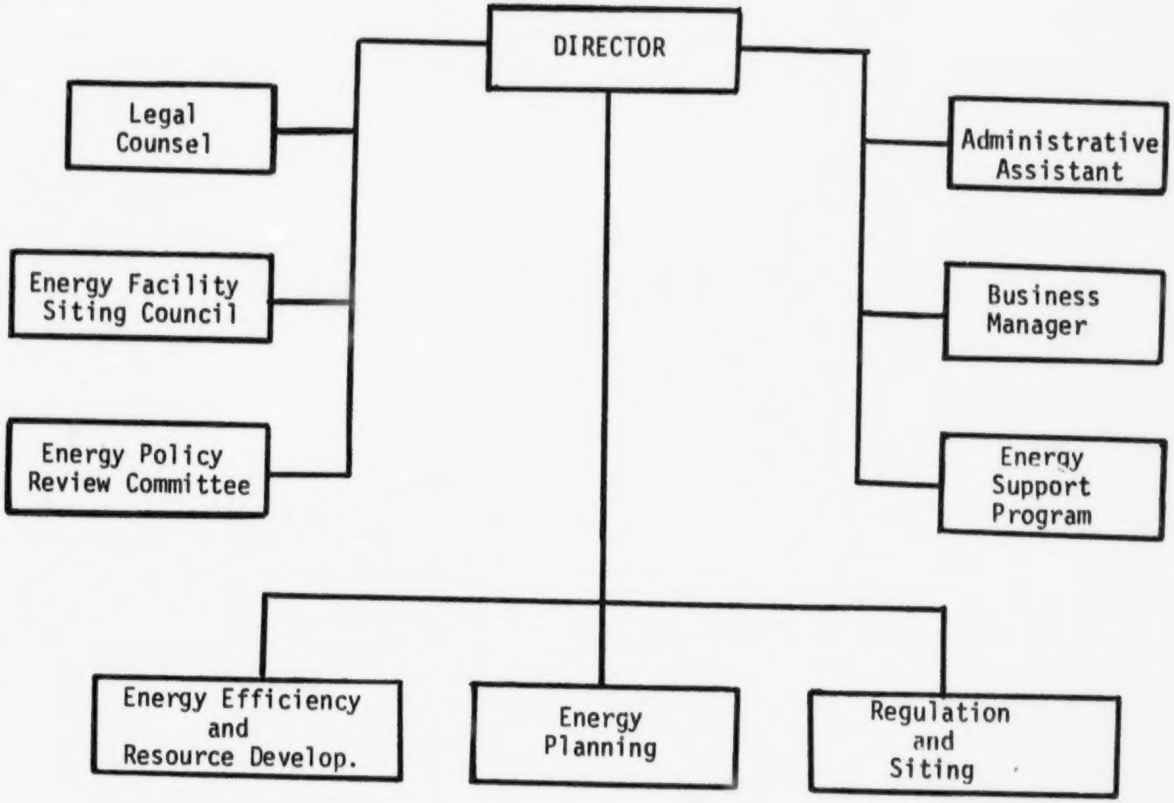
Finally, it has been projected that all energy related occupations within the state will experience considerable growth and diversification during the coming ten years. This growth will be a consequence of growing energy demands, searches for alternative sources of energy, and meeting the guidelines established by environmental legislation.

STATE OF OREGON

DEPARTMENT OF ENERGY

Organizational Chart

Figure 2.0


DIRECTOR
Legal Counsel
Energy Facility Siting Council
Energy Policy Review Committee
Administrative Assistant
Business Manager
Energy Support Program
Energy Efficiency and Resource Develop.
Energy Planning
Regulation and Siting

U.S. ENVIRONMENTAL PROTECTION AGENCY
Corvallis Environmental Research Laboratory
Corvallis, Oregon

U.S. ENVIRONMENTAL PROTECTION AGENCY
Corvallis Environmental Research Laboratory
Corvallis, Oregon

A. Introduction

The Corvallis Environmental Research Laboratory was originally authorized in 1961 by a Congressional amendment to the Federal Water Pollution Control Act. In 1970 when the U.S. Environmental Protection Agency was established as an independent federal agency, the laboratory was merged into the new agency. Of the major U.S. EPA laboratories, the Corvallis Laboratory is the only one concerned with the effects of pollutants on total ecosystems linking air, land, and water.

Current ecological research focuses on problems resulting from new or intensified human activities on limited air, land, and water resources. Research attempts to include consideration of industrial growth and diversification, growth of agricultural and forest productivity, transportation, land use, energy development, recreational pursuits and demands, and social and economic consequences of pollution.

The laboratory has defined ten principal research concentations:

1) research on the effects of air pollutants on vegetation, animals, and total ecosystems;

2) research on the effects of pollutants on aquatic plants and animals, and including assessing the social and eco

3) research on the feasibility of restoring polluted or deteriorating lakes via construction of municipal waste treatment facilities to reduce the inflow of plant nutrients such as phosphorus and nitrogen;

4) research on corrective measures for lakes with problem conditions exist as a consequence of diffuse nutrient sources and other pollutants;

5) research on non-point source water pollution such as runoff from croplands, forests, urban stormwaters, stripmining, and watersheds ;

6) research designed to delineate the boundaries of wetlands to insure proper jurisdiction for EPA and the Corps of Engineers decisions on dredge spoil disposal;

7) research on the effects of pollutants on plants and animals living in coastal and tidal areas, the movement of pollutants through these ecosystems, and the degradation of pollutants there;

8) research designed to test and demonstrate innovate waste treatment and water conservation techniques that could improve community sanitation methods in cold climates, and at the same time enhance environmental health conditions in rural Alaska;

9) research on terrestrial microcosms representing a practical, intermediate investigative level between the test tube and field studies and, as the systems are balanced and functioning, selected pesticides are added so that their movements can be traced;

10) research on pollution caused by the extraction of coal and other energy resources, energy production itself, and transmission of energy from the point of production to the point of use and on techniques for reclaiming land areas impacted by energy resource development.

The Laboratory is composed of four basic administrative units: Ecological Effects Research Division, Assessment and Criteria Development Division, Laboratory Operations and Support Staff, and Laboratory Analytical Support Staff. The Ecological Effects Research Division is primarily concerned with research programs on the effects of environmental pollutants on freshwater, marine water, and terrestrial ecosystems. There are three branches within the division: Terrestrial Ecology Branch, Marine and Freshwater Ecology Branch, and Western Fish Toxicology Station. The Marine and Freshwater Ecology Branch conducts research to determine the environmental impact of pollutants discharged into marine, freshwater, and estuarine environments. The branch also develops and collects data on the ecological requirements of protecting plant and animal life in those areas. The Newport Field Station is an administrative section of the branch. The Newport station, located in Newport, Oregon, conducts marine and estuarine research.

The Terrestrial Ecology Branch is responsible for research on the effects of gaseous and particulate pollutants, pesticides, heavy metals, and other toxic substances on vegetation, domestic animals, and wildlife. This branch also prepares studies on the movements of these pollutants through entire chains and provides data for setting or revising air quality standards for the nation.

The Western Fish Toxicology Station, located in Corvallis, Oregon, is involved with research on the effects of supersaturation and heavy metals on fish and other aquatic organisms native to the Pacific Northwest. The Station conducts studies on the ability of fish and other aquatic life to live and reproduce in the presence of heavy metals and other toxic materials.

The Assessment and Criteria Development Division conducts basic research in the following four areas:

1) the effects of forest management practices on stream life;
2) on criteria for protecting wetland habitats for fish and birds;

3) statistical analysis and mathematical prediction of long-term environmental effects of pollutions;

4) associated social and economic impacts of pollutants on freshwater, marine, and terrestrial ecosystems.

The functions of the division are centralized in four program branches: Criteria and Assessment Branch, Ecosystems Modeling and Analysis Branch, Special Studies Branch, and Arctic Environmental Research Station.

The Criteria and Assessment Branch provides comprehensive environmental assessment of the impact of pollutants on freshwater, estuarine, marine, and terrestrial ecosystems, including ecological and socioeconomic evaluations. The Ecosystems Modeling and Analysis Branch studies the impacts of pollutants and environmental stress on total ecosystems.

The Special Studies Branch conducts specialized studies to determine how pollutants from agricultural and forested lands impact aquatic environments. This branch also shares responsibility with the U.S. National Guard and the Las Vegas Environmental Monitoring Support Laboratory for the National Eutrophication Survey of some 800 deteriorating lakes in the United States.

The Arctic Environmental Research Station, located in College, Alaska, conducts research on the effects of pollutants in cold-climate environments and demonstrates technology for controlling pollution problems in those areas.

The overall administration of the Corvallis Laboratory is the responsibility of the Laboratory Operations and Support Staff. Services provided by this division include program planning and coordination, financial management, purchasing, personnel services, security, safety, and facilities management.

The Laboratory Analytical Support Staff assists the two research divisions in the analysis of chemical and biological samples. The division also manages, operates, and calibrates an array of sophisticated analytical equipment and provides automatic data processing, computer programming, and technical information support.

B. Workforce Profile

The Corvallis Laboratory has a current staffing level of 134 employees: 134 professional, 13 technical, and 3 clerical. The following table provides a review of the distribution of staff by occupational type:

TABLE XXII

U.S. ENVIRONMENTAL PROTECTION AGENCY

Corvallis Environmental Research Laboratory
Current (1976) Staffing Level

Position	1976
Administrator	14
Scientist	82
Engineer	15
Statistician	2
Technician	9
Clerical	3
Other	9
TOTAL	134

The Other category includes a carpenter, plumber, electrician, general mechanic, and five non-scientific professionals. The laboratory was able to provide the following training and educational background analysis for its professional staff (excluding the administrative segment).

TABLE XXIII

U.S. ENVIRONMENTAL PROTECTION AGENCY

Corvallis Environmental Research Laboratory
Professional Staff Educational Training Level

Discipline	B.S.	B.A.	M.S.	M.A.	D.V.M.	Ph.D.	Total
Biological & Agricultural Sciences	12	2	16	2	1	19	52
Chemistry	14		3			3	20
Engineering	8		3			4	15
Mathematics & Statistics			1			1	2
Physical Sciences	4		2			4	10
Other	2	1	1	1			5
TOTAL	40	3	26	3	1	31	104

Turnover rate for the total laboratory staff is estimated at 3 to 5 percent annually. This turnover is considered as average for a program the size of the laboratory.

C. Workforce Projections

Over the past two years, the laboratory has experienced a declining in staffing level due to a lack of funds. Nevertheless, sources at the laboratory indicated that they were optimistic concerning future growth; they predicted a staff increase of from 2 to 10 percent per annum. The laboratory expects to continue research efforts similar to those reported in the introduction to this section.

D. Training and Certification

The Corvallis Laboratory has a very liberal training policy which encourages professional development. The proximity of the laboratory to Oregon State University provides the right climate for continuing education by the laboratory staff. During fiscal year 1976, 104 laboratory employees attended 185 courses in a variety of scientific, technical, and administrative fields. Since fiscal year 1976 covered a 15 month period, it is fair to assume that during an average 12 month year the number of courses attended and the number of employees involved would be approximately 20 percent less.

E. Career Potential

During recent years, the Corvallis Laboratory has experienced a decline in staff as a consequence of stable funding levels and rising inflationary costs. Nevertheless, sources at the laboratory suggested that various economic and social indicators support continued and increased funding of the research efforts ongoing at the laboratory. Consequently, the sources have predicted future growth for the laboratory at an estimated 2 to 10 percent per annum. Growth in staffing would occur at all levels, with the emphasis on professional grades.

F. Conclusion

The Corvallis Laboratory is conducting research on a variety of necessary environmental issues. The Laboratory is the only major EPA laboratory which is concerned with the effects of pollutants on total ecosystems linking air, land, and water. While the laboratory has experienced a negative growth pattern over the past two years as a consequence of rising program costs, the laboratory projects growth in staffing between 1977 and 1982. The extent and nature of staff growth will be dependent upon the availability and source of funds.

Selected Post Secondary Institutions With Formal Environmental Energy Programs

The State of Oregon offers a variety of environmentally-related programs throughout its educational system. There are programs on the graduate, four-year, two-year, and one-year level available to persons interested in obtaining degrees, certificates, or diplomas.

Linnfield College and Oregon State University are two of the four-year institutions which offer degrees in the environmental field. Two-year institutions which offer either degrees, certificates, or diplomas or simply environmental courses include Clackamas Community College, Umpqua Community College, Linn-Benton Community College, Treasure Valley Community College, Southwestern Oregon Community College, and the Oregon Institute of Technology. Programs include environmental health, environmental health technology, wastewater technology, water treatment/waste water technology, water/waste water plant operations, environmental sciences, and environmental studies.

On the following pages, a more detailed outline of programs at Linn-Benton Community College and Oregon State University are presented.

Oregon State University
Corvallis, Oregon

Program: Environmental Health (B.S., B.A., M.A., Ph.D.)

Hours required for major: Quarter - (B.S., B.A.) 192
Staff Size: One full-time and one part-time professor.
Enrollment: (B.S. plus B.A.) 16, (M.A.) 2, (Ph.D.) 1
Graduates: (B.S.) 6, (M.A.) 2, (Ph.D.) 1
Placement: 7 (cumulative)
Graduate Work: 0

Courses

Principles of Accident Prevention
Health Agencies and Programs
Environmental Health
Institutional Hygiene
Epidemiology
Field Experience
Evaluation
Vectors and Solid Waste
General Biology
Mathematics
General Physics
Soils
Nutrition
Organic Chemistry
Introduction to the Atmosphere
General Microbiology
Applied Entomology
Environmental Law: Water and Air
Food Microbiology
Dairy and Industry Biotransformations
Biology of Radiation

Linn-Benton Community College
Albany, Oregon

Program: Wastewater Technology (A.A.S.)

Hours required for major: Quarter - 102
Program Inception: 1971
Staff Size: Six instructors
Enrollment: 24
Graduates (1976): 15
Placement: 15
Graduate Work: not available

Courses (selected)

Aquatic Microbiology
Basic Protozoology
Collection and Pre-Treatment
Primary/Secondary Sedimentation/Digester Operational Control
Introduction to Activated Sludge and Trickling Filters
Process Interaction
Advanced Waste Treatment
Introduction to Potable Water Systems
Water Sources
Water Distribution
Water Purification Systems
In Plant Practicum
Basic Aquatic Chemistry
Inter. Aquatic Chemistry
Advanced Aquatic Chemistry
Wastewater Mechanics, I, II
Water/Wastewater Treatment Plant Operator I, II, III
Applied Hydraulics
Water Treatment
Water Treatment Facilities
Distribution Systems
Disinfection and Fluoridation
Special Water Treatment
Wastewater Treatment
Primary Treatment
Secondary Treatment I, II
Advanced Waste Treatment
Management of Water and Wastewater Systems
Practical Hydraulics
Sludge Handling
Sanitary Microbiology
Sanitary Chemistry

Program: Water Treatment/Wastewater Technology (A.A.S.)

Hours required for major: Quarter - 103
Program Inception: 1976
Staff Size: Six instructors.
Enrollment: 24
Graduates (1976): 15
Placement: not available
Graduate Work: not available

Courses

Same as above.

Program: Water/Wastewater Plant Operations (Certificate)

Hours required for major: Quarter - 66
Program Inception: 1969
Staff Size: Six instructors.
Enrollment: 24
Graduates (1976): 14
Placement: 12
Graduate Work: not available

Courses

Same as above.

State Legislation

OREGON GENERAL

TITLE:

Environmental Quality Commission Law
Oregon Statutes 468.005

PURPOSE:

To provide for the development and coordination of state environmental policies, and to create an environmental quality commission.

DEFINITIONS:

1. Commission
2. Department
3. Director
4. Order
5. Person
6. Rule
7. Standard

ADMINISTERING AUTHORITY:

Environmental Quality Commission
Department of Environmental Quality

AUTHORIZATIONS:

To adopt rules and standards pursuant to the law;
To promote environmental preservation and restoration;
To conduct environmental studies and investigations;
To supervise air and water pollution control programs;
To act as the state lead agency in air and water matters;
To enforce environmental quality laws;
To administer environmental permit programs.

PROHIBITED ACTS:

To violate any provisions of the law, or rules or standards issued thereunder.

PENALTIES:

General violations - fines of up to $500;
Intentional oil discharges - fines of up to $20,000.

OREGON AIR

TITLE:

Air and Motor Vehicle Pollution Control Law
Oregon Statutes 468.275

PURPOSE:

To provide for a statewide program of air quality control and motor vehicle emission control.

DEFINITIONS:

1. Air-cleaning device
2. Air contaminant
3. Air contamination
4. Air contamination source
5. Air pollution
6. Area of the state
7. Certified system
8. Factory-installed system
9. Motor vehicle
10. Motor vehicle pollution control system

ADMINISTERING AUTHORITY:

Environmental Quality Commission
Department of Environmental Quality

AUTHORIZATIONS:

To establish air quality standards for different regions of the state;
To develop a comprehensive air pollution abatement plan;
To issue permits for air contamination sources and approve new construction;
To grant variances under the law;
To adopt motor vehicle emission standards;
To adopt criteria for motor vehicle pollution control systems;
To license motor vehicle inspectors;
To control motor vehicle operation and traffic;
To generally enforce the law.

PROHIBITED ACTS:

To cause or allow air contaminant discharge;
To fail to obtain permits as required;
To sell or install non-certified motor vehicle pollution control device;
To fail to obey any orders or other regulations issued under the law.

EXEMPTIONS:

Agricultural operations and equipment used therein; heating and barbecue equipment and similar devices.

PENALTIES:

Fines of up to $500.

OREGON NOISE

TITLE:

Noise Control Law
Oregon Statutes 467

PURPOSE:

To protect the health, safety and welfare of citizens of the state from the hazards of unreasonable noise levels.

DEFINITIONS:

ADMINISTERING AUTHORITY:

Environmental Quality Commission

AUTHORIZATIONS:

To adopt noise control regulations;
To establish noise source categories;
To establish noise emission standards and levels;
To enforce the act.

PROHIBITED ACTS:

To cause or allow noise emissions in excess of established levels.

PENALTIES:

Violation constitutes Class B misdemeanor.

OREGON PESTICIDES

TITLE:

State Pesticide Control Act
Oregon Statutes 634.006

PURPOSE:

To provide for the licensing of pesticide applicators and to control pesticides through registration.

DEFINITIONS:

1. Antidote
2. Brand or trademark
3. Defoliant
4. Department
5. Desiccant
6. Device
7. Fungicide
8. Herbicide
9. Highly toxic
10. Insecticide
11. Land owner
12. Nematocide
13. Pesticide
14. Pesticide applicator
15. Pesticide consultant
16. Pesticide dealer
17. Pesticide equipment
18. Pesticide operator
19. Pesticide trainee
20. Plant regulator
21. Private applicator
22. Professed standard of quality
23. Protected area
24. Public applicator
25. Public trainee
26. Registrant
27. Restricted area
28. Restricted use pesticide
29. Weed

ADMINISTERING AUTHORITY:

Department of Agriculture

AUTHORIZATIONS:

To classify pesticides and restrict pesticide usage;
To generally enforce the act;
To issue regulations pursuant to the act;

AUTHORIZATIONS (Cont'd):

To require the registration of pesticides;
To control the storage and disposal of pesticides;
To license pesticide dealers;
To categorize commercial applicators and establish applicator certification standards;
To certify commercial and private applicators;
To issue experimental use permits;
To develop a state pesticide plan.

CERTIFICATION OR LICENSING:

License required for custom applicators and certification required for all restricted use applicators;
Showing of competence and other qualifications required;
Categories of applicator, consultant, operator, private applicator, public applicator, and public trainee are established.

PROHIBITED ACTS:

To fail to comply with pesticide registration requirements;
To alter or destroy pesticide labels;
To dispose of pesticides or containers in a manner harmful to environment;
To engage in custom application of pesticides without license;
To apply restricted use pesticides without certification;
To violate other act provisions.

EXEMPTIONS:

State and local government agencies, farmers and land owners, gardeners, and manual laborers.

PENALTIES:

First offense - fines of up to $1,000 or one year imprisonment;
Subsequent offenses - fines of up to $2,000 or one year imprisonment.

OREGON SOLID WASTE

TITLE:

Beverage Container Law
Oregon Statutes 459.810

PURPOSE:

To provide for the control of litter and solid waste problems through the establishment of a beverage container refund law.

DEFINITIONS:

1. Beverage
2. Beverage container
3. Commission
4. Consumer
5. Dealer
6. Distributer
7. In this state
8. Manufacturer
9. Place of business of a dealer
10. Use or consumption

ADMINISTERING AUTHORITY:

Liquor Control Commission

AUTHORIZATIONS:

To certify beverage containers as reusable;
To approve beverage container redemption centers;
To take such other action as is necessary to carry out the act.

PROHIBITED ACTS:

To sell or offer for sell beverage containers with a refund of less than five cents or less than two cents if reusable;

PROHIBITED ACTS:

To fail or refuse to pay to any person the refund value of a returned beverage container;
To sell or offer for sell beverage containers a part of which is detachable in opening;
To operate a beverage container redemption center without proper approval.

PENALTIES:

Violation constitutes a Class A misdemeanor.

OREGON SOLID WASTE

TITLE:

Hazardous Wastes Law
Oregon Statutes 459.410

PURPOSE:

To provide for a special program of disposal control of environmentally hazardous wastes.

DEFINITIONS:

1. Commission
2. Department
3. Director
4. Dispose
5. Disposal site
6. Environmentally hazardous wastes
7. Nuclear installation

ADMINISTERING AUTHORITY:

Department of Environmental Quality
Environmental Quality Commission

AUTHORIZATIONS:

To study disposal site availability for environmentally hazardous wastes;
To generally supervise the disposal of environmentally hazardous wastes;
To issue regulations relating to the control of hazardous wastes;
To issue licenses for special disposal sites;
To generally enforce the act.

PROHIBITED ACTS:

To operate a disposal site without a license;
To dispose of environmentally hazardous wastes other than at a designated disposal site;
To violate other act provisions.

PENALTIES:

Fines of up to $3,000 or one year imprisonment;
Liability imposed for property damage caused by improper disposal of hazardous wastes.

OREGON SOLID WASTE

TITLE:

Solid Waste Management Law
Oregon Statutes 459.005

PURPOSE:

To protect the public health, safety and welfare of the people of the state through the establishment of a comprehensive statewide program of solid waste management.

DEFINITIONS:

1. Board of County Commissioners
2. Commission
3. Department
4. Disposal site
5. Local government unit
6. Permit
7. Person
8. Salvage
9. Solid waste collection service
10. Solid waste
11. Solid waste management
12. Transfer station
13. Waste

ADMINISTERING AUTHORITY:

Department of Environmental Quality
Local Governmental Units

AUTHORIZATIONS:

To coordinate studies regarding solid waste management;
To act as the state lead agency in solid waste matters;
To provide technical assistance to local governmental units regarding solid waste matters;
To issue regulations relating to solid waste storage, collection, and disposal;

AUTHORIZATIONS (Cont'd):

To regulate solid waste storage and disposal at the local level;
To issue permits for solid waste disposal sites;
To generally enforce the act.

PROHIBITED ACTS:

To operate or maintain a solid waste disposal facility without a permit;
To violate any other regulation or orders issued under the act.

EXEMPTIONS:

Certain disposal sites may be exempted from permit requirement by regulation.

PENALTIES:

Criminal - violation constitutes a Class A misdemeanor;
Civil - fines of up to $500 per day.

OREGON WASTE WATER

TITLE:

Water Pollution Control Law
Oregon Statutes 458.700

PURPOSE:

To conserve and protect from pollution the water resources of the state, including the prevention of oil spillages.

DEFINITIONS:

1. Disposal system
2. Industrial waste
3. Pollution
4. Sewage
5. Sewerage system
6. Treatment works
7. Wastes
8. Waters of the state
9. Oil
10. Person having control
11. Ship

ADMINISTERING AUTHORITY:

Environmental Quality Commission
Department of Environmental Quality

AUTHORIZATIONS:

To prevent water pollution in the state;
To establish water quality standards and effluent limitations;
To administer water discharge permit program;
To approve disposal system construction;
To control use of synthetic cleansing agents;
To supervise oil spill cleanup operations.

PROHIBITED ACTS:

To cause or allow water pollution in the state;
To violate the terms of any permit;
To sell non-biodegradable synthetic cleansing agents;
To deposit motor vehicles into waters of the state;
To discharge oil from a ship into state waters;
To fail to undertake oil spill cleanup operations.

PENALTIES:

Willful water pollution violations - fines of up to $25,000 or one year in jail;
Liability imposed for damage caused by water pollution and oil cleanup expenses.

OREGON ENERGY

TITLE:

Energy Conservation Law
Oregon Statutes 469

PURPOSE:

To provide for the efficient use of energy resources, to develop permanently sustainable energy resources, and to create a department of energy.

DEFINITIONS:

1. Agency
2. Coal supplier
3. Council
4. Department
5. Director
6. Energy facility
7. Person
8. Petroleum supplier
9. Related or supporting facilities
10. Site
11. Thermal power plant
12. Utility

ADMINISTERING AUTHORITY:

Department of Energy

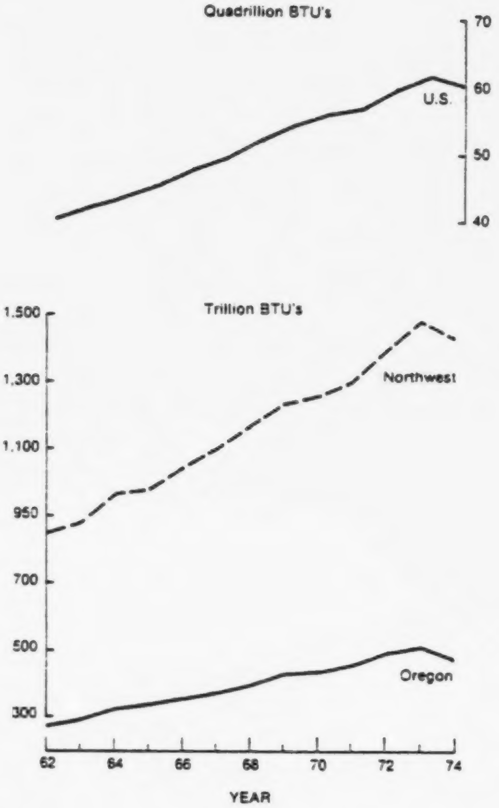
AUTHORIZATIONS:

To collect energy resource data;
To conduct energy research;
To develop energy contingency programs;
To report to the Governor and Legislature on energy matters;
To act as the state lead agency on energy matters;
To prepare an annual energy forecast.

Appendix

Chapter II

FIGURE 2.1
HISTORICAL
TOTAL ENERGY CONSUMPTION
U.S., NORTHWEST, OREGON



II. ENERGY USES IN OREGON: A SUMMARY PERSPECTIVE

Valid assessments of Oregon's future energy needs must, to a large degree, evolve from an understanding of past and present energy use patterns. To develop that understanding, DOE has collected and analyzed a broad spectrum of energy-related data illustrative of the Oregon experience.

Although our knowledge on energy use patterns has expanded dramatically in recent years, it is not yet complete. The analysis of complex energy issues is, in some areas, inhibited by limited data. Continued research and analysis of energy use patterns and trends will provide a sound and reliable basis for vital energy decisions, now and in the future.

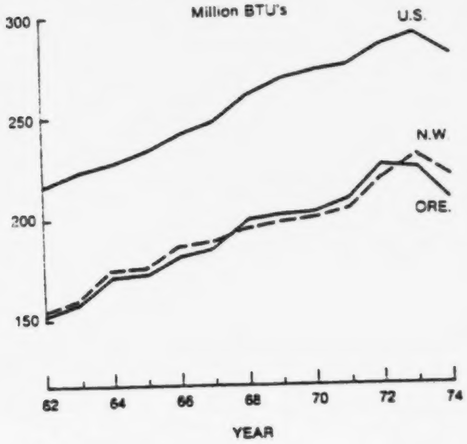
This chapter provides some broad perspectives on key energy use patterns in Oregon's five primary economic sectors: residential, commercial, industrial, transportation, and agriculture.[1]

Some Overall Consumption Trends

Oregon's energy consumption peaked in 1973 at about 500.1 trillion BTU's.[2] In the preceding decade, the State's annual energy growth rate averaged less than 5 percent. In 1974, total consumption dropped to 477 trillion BTU's, less than one percent of total U.S. consumption. Economic recession and energy conservation efforts were major factors in consumption's downward trend. *Figure 2.1* compares historical trends in total energy use in Oregon, the Pacific Northwest, and the U.S.

Historical trends in per capita energy consumption (*Figure 2.2*) provides an exceedingly gross measure of how intensively energy is used. This is particuarly true at the state or regional level where significant differences in economic structure are encountered. It is interesting to note, however, that while per capita energy use in the Northwest and the U.S. grew at comparable rates from 1962-74, the region's per capita consumption has remained well below the national average. Per capita energy usage in Oregon has paralleled the regional average.

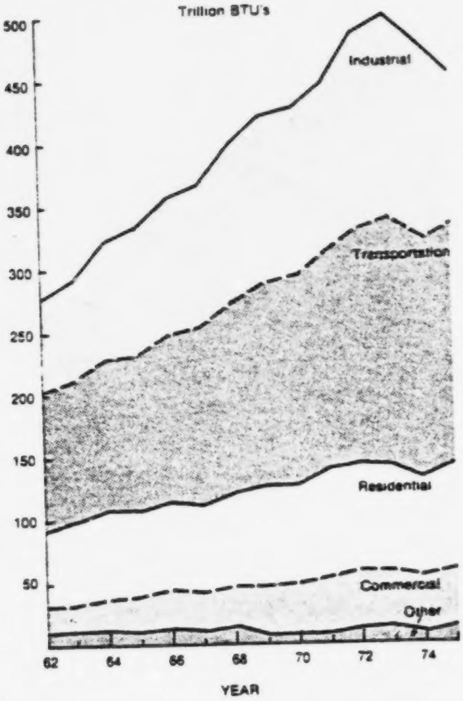
FIGURE 2.2 HISTORICAL PER CAPITA ENERGY CONSUMPTION U.S., NORTHWEST, OREGON



Energy Use By Sector

A clearer and more informative picture of energy use is drawn from a detailed analysis of specific economic sectors. It is at this level that the relationships between specific end uses and the demands for specific fuels becomes apparent, *Figure 2.3* defines Oregon's historical energy use by sector.

FIGURE 2.3 OREGON HISTORICAL ENERGY CONSUMPTION (ACCUMULATIVE)

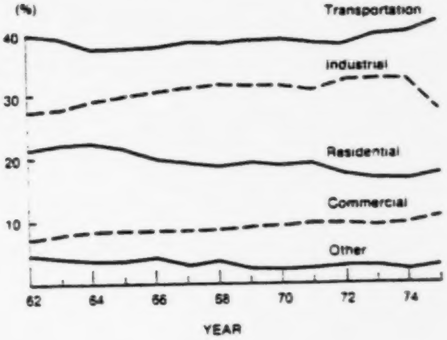


The Residential Sector

Oregon's households comprise the State's third largest energy consuming sector. They account for approximately 17 percent of total consumption. Residential consumption increased almost 5 percent annually from 1962-72, then registered declines in the next two years.

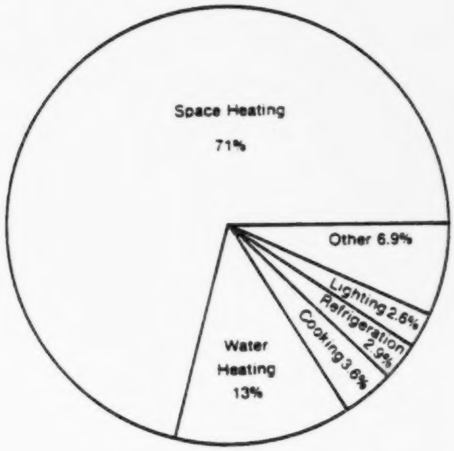
While the sector has maintained its relative share of total energy consumption, its absolute share declined gradually since the early 1960s (*Figure 2.5*).

FIGURE 2.5 HISTORICAL PERCENTAGE OF TOTAL ENERGY CONSUMPTION BY SECTOR



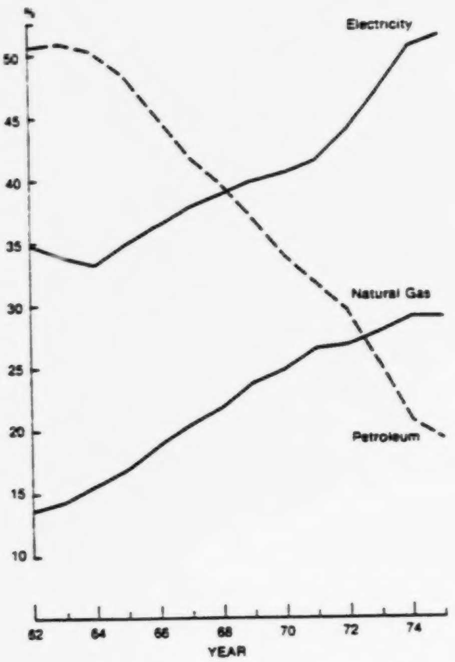
Household energy consumption in the state is divided among numerous end uses, but usage is dominated by space and water heating (*Figure 2.4*).

FIGURE 2.4 RESIDENTIAL END USES OREGON 1970[3]



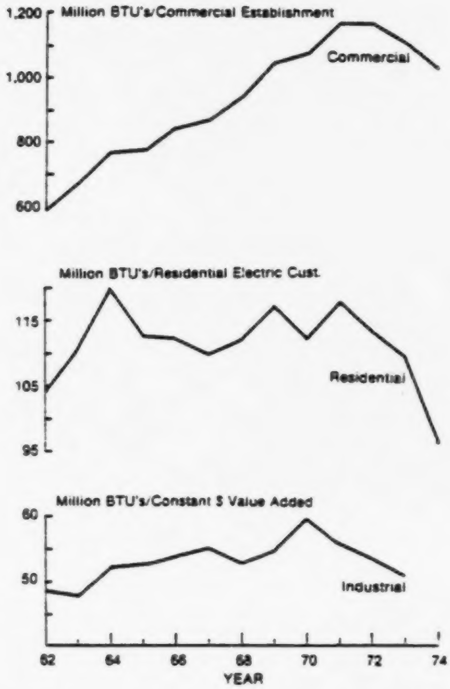
Residential energy use (*Figure 2.6*) has seen dramatic growth in the importance of electricity and natural gas at the expense of petroleum products over the entire period from 1962-1974. Electricity now accounts for about half of residential consumption.

FIGURE 2.6 CHANGING COMPOSITION OF ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR



The intensity of residential usage (*Figure 2.7*) peaked by 1971, dropping off sharply in subsequent years. By 1974, per household consumption had actually fallen below the 1962 level. The factors underlying this trend are complex and still not well understood.[5]

FIGURE 2.7
ENERGY INTENSIVENESS BY SECTOR[4]



Future trends in household energy usage will be influenced by three primary factors: relative fuel prices, consumer expectations on the availability of different fuels, and by the implementation of insulation standards and other policies affecting the residential sector.

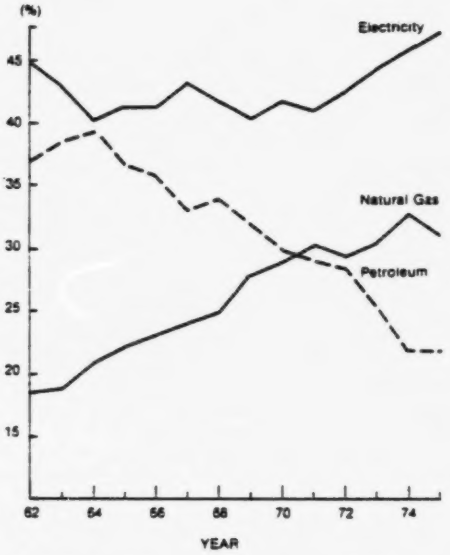
The Commercial Sector

The commercial sector is the fourth largest energy-using sector in the state. It accounts for about 9 percent of Oregon's total energy consumption. Usage patterns in this sector closely resemble those in the residential sector with most of the energy applied to space and water heating.

Commercial energy use has experienced relatively rapid growth, averaging 8.1 percent annually from 1962-1975 (*Figure 2.3*). As in the residential sector, energy use declined between 1972 and 1974. The commercial sector's share of total energy consumption has remained virtually constant since 1962.

As in the residential sector, natural gas and electricity have steadily increased their shares of total energy usage at the expense of petroleum (*Figure 2.8*).

FIGURE 2.8
CHANGING COMPOSITION OF ENERGY CONSUMPTION IN THE COMMERCIAL SECTOR



The sector's rapid growth in usage through 1972 was strongly affected by the increasing consumption of individual commercial establishments (*Figure 2.7*). By 1974, usage per commercial establishment declined to just over one billion BTU's, about ten times the average household usage. This reduction can be traced to the same factors that affected residential usage[6] but with the pressures of recession perhaps playing a significant role.

Future usage in this sector will be a function of many factors including new energy efficiency standards. There are no thermal efficiency standards for commercial buildings although some are being considered.

The Industrial Sector

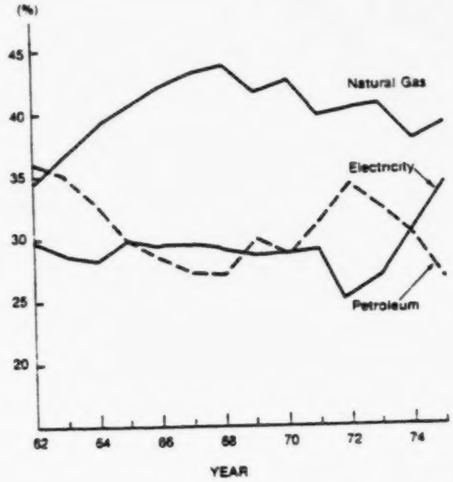
The industrial sector is by far the most diverse and complex of the sectors discussed here. It is second only to transportation in the total energy consumed. In

1974, the industrial sector used about 154 trillion BTU's, 32 percent of Oregon's total energy consumption. Of this, about 86 percent was consumed by Oregon's manufacturing industries.

Industrial energy usage increased approximately 7.1 percent annually from 1962-73 (*Figure 2.3*). Industrial use declined four percent in 1974 due to the combined effects of recession and conservation efforts. All of this decline was attributable to falling natural gas and petroleum usage. Electricity consumption continued to increase.

Figure 2.9 illustrates how the composition of industrial energy consumption has changed since 1962. Each of Oregon's three major energy sources registered dramatic growth during this period. The shares of total industrial usage represented by petroleum and natual gas have fluctuated significantly, in part, reflecting shifts in the relative prices of these fuels. In contrast, electricity's share of total usage remained fairly constant. This is because industrial uses of electricity have been limited mainly to applications where other fuels are not readily substituted. In the future, petroleum is expected to show major increases as industrial use of natural gas declines. In addition, the industrial sector could well see expanded usage of other sources, especially coal. Electricity will continue to play an important role.

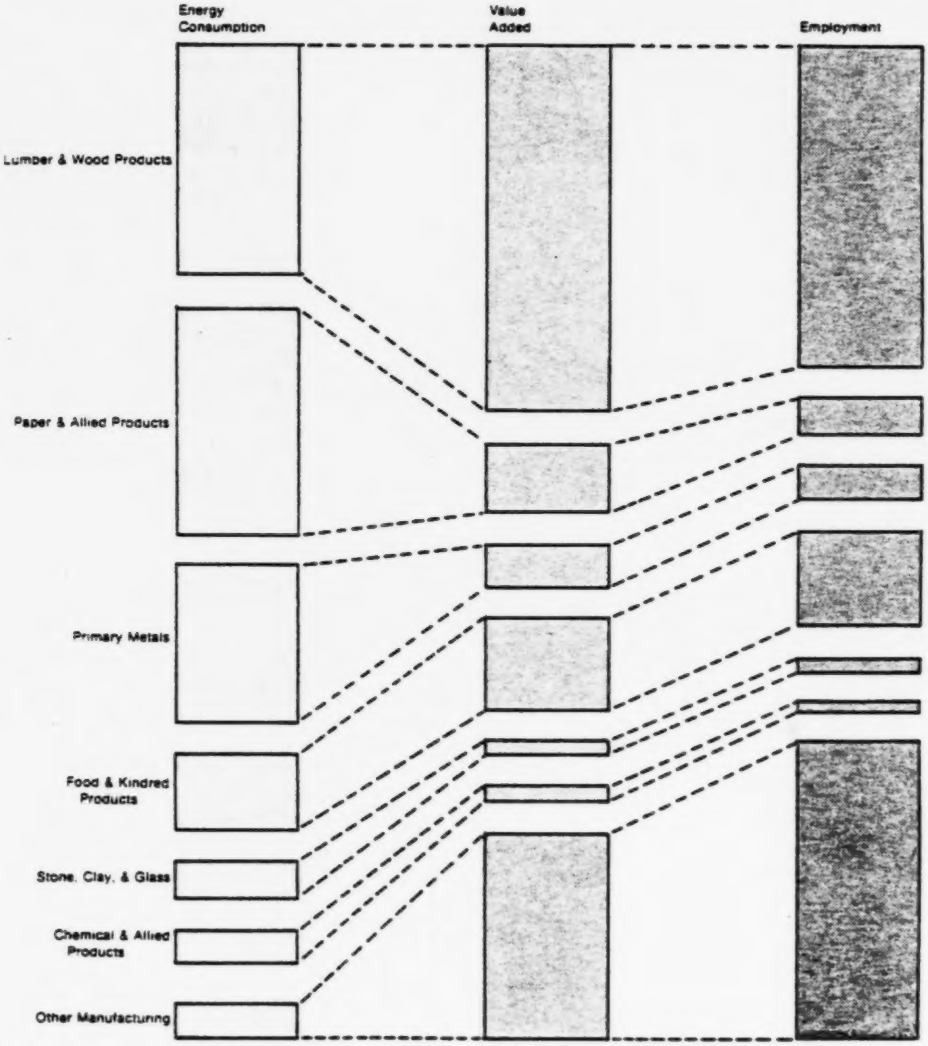
FIGURE 2.9
CHANGING COMPOSITION OF ENERGY IN THE INDUSTRIAL SECTOR



The rapid growth in industrial energy consumption was influenced in part by the increasing energy intensiveness of Oregon's manufacturing industries (*Figure 2.7*).

Figure 2.10 presents a breakdown of six industries which in 1973 accounted for approximately 96 percent of the energy consumed by Oregon's manufacturing sectors. The figure shows the direct energy consumption for each industry. It also illustrates each industry's direct contribution to the State's economy in terms of value added and persons employed. (Inclusion of indirect contributions to value added and employment would not affect this picture appreciably). By combining the information in *Figure 2.10*, the relative energy intensiveness of six key manufacturing industries is expressed quantitatively in *Table 2.1*.

FIGURE 2.10
ENERGY CONSUMPTION — ECONOMIC CONTRIBUTION RELATIONSHIPS FOR OREGON INDUSTRIES'



Future industrial energy usage will depend on energy prices and availability and on public policies that are adopted.

TABLE 2.11
ENERGY INTENSIVENESS OF SIX MANUFACTURING INDUSTRIES IN OREGON[8]

MAJOR SUBSECTOR	Value Added Per Million BTU	# of Employes Per Billion BTU
Lumber & Wood Products (SIC 24)	46.80	1.78
Paper & Allied Products (SIC 26)	9.38	0.23
Primary Metals (SIC 33)	7.76	0.31
Food & Kindred Products (SIC 20)	37.39	1.73
Stone, Clay & Glass (SIC 32)	11.11	0.49
Chemicals & Allied Products (SIC 28)	13.4	0.34
AVERAGE	23.71	0.89

Most evidence suggests that the greatest potential for energy conservation is in the industrial sector and that, in the long run, industrial demand for energy is extremely price responsive. That is, as energy prices rise, firms will find it economical to use more energy efficient equipment and processes. In addition, the State has a wide range of policy options to influence future industrial energy consumption. These range from measures such as financial incentives to promote the installation of more energy efficient equipment to a general state policy that encourages economic growth that is less energy intensive.

Evaluation of the future energy needs of Oregon industry is presently hampered by a lack of detailed information on historical and current energy uses in the manufacturing sector. The DOE has initiated studies of key energy-consuming industries, and the results will be presented in subsequent reports.

The Transportation Sector

Transportation is the largest single energy-using sector in Oregon. In 1974, this sector consumed about 190 trillion BTU's or 40 percent of the State's energy consumption (*Figure 2.3*). Transportation's energy usage is distributed as follows: trucks and buses—12 percent; railroads—8 percent; aviation—5 percent; automobiles—75 percent. Energy used for transportation grew at an average annual rate of 5.4 percent from 1962-1973.

Petroleum products—gasoline, diesel fuel, jet fuel and residual oil—account for virtually all of the energy consumed in transportation. A small amount of electricity is used for street and highway lighting.

Growth in transportation usage is in part due to increasing numbers of vehicle miles driven. But it also stems from the historical shift to modes of transportation that are less efficient.

Future energy usage in this sector will be influenced by many factors, but the potential for conservation under current modes of transportation is substantial. Higher prices have already had some impact on usage patterns by encouraging the use of smaller vehicles. Federal standards on new automobiles should substantially improve the average vehicle mileage in coming years.

The Agricultural Sector

In 1974, agriculture used about five trillion BTU's, about 1 percent of Oregon's total energy consumption. The sector's energy consumption fluctuated markedly from 1962-73, with annual growth averaging 1.6 percent. In 1974, 37 percent decline occurred in energy consumption bring total usage well below the 1962 level.

Energy consumed in agriculture includes diesel fuel used in off-highway vehicles, liquid petroleum gas, and electricity for irrigation. Petroleum usage has fluctuated widely over time, and its share of sectoral consumption declined from 92 percent to 52 percent fromf 1962-74. Electricity, in contrast, has experienced phenomenal growth of 13.5 percent annually, its share of agricultural usage increasing from 8 to 46 percent since 1967.

Future growth in agricultural energy usage will be tied largely to irrigation trends.

Chapter III

III. OREGON'S ENERGY RESOURCES

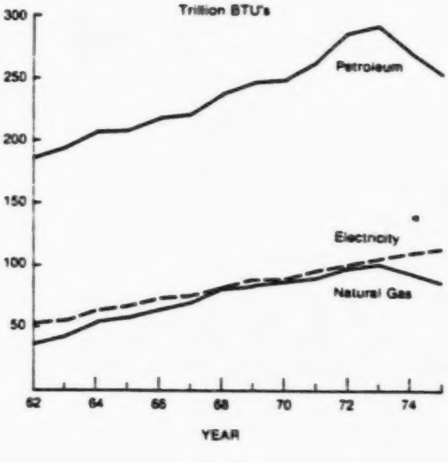
Oregon's specific energy use patterns are dependent on sufficient and uninterrupted supplies of energy. Recent events have raised uncertainties concerning the extent and continuity of our traditional supplies and the future availability of alternative energy sources.

This chapter summarizes the historical role of Oregon's traditional energy resources and assesses their future availability. In addition, the prospective role of alternative energy sources is tentatively evaluated.

Petroleum Products

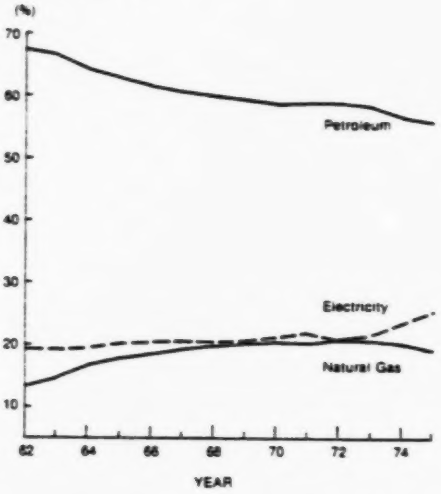
In 1974, petroleum products comprised 57 percent of the State's total energy consumption (*Figures 3.1 and 3.2*). Petroleum usage peaked in 1973 after growing at an annual rate of 4.2 percent since 1962. A 7 percent decline was experienced in 1974. As shown, petroleum's share of total consumption has been declining since 1962.

FIGURE 3.1
OREGON ENERGY
CONSUMPTION BY SOURCE



The petroleum products consumed in Oregon include gasoline, distillate and residual fuel oils, liquid petroleum gas, jet fuel, and kerosene. The transportation sector is responsible for about 70 percent of the State's petroleum usage.

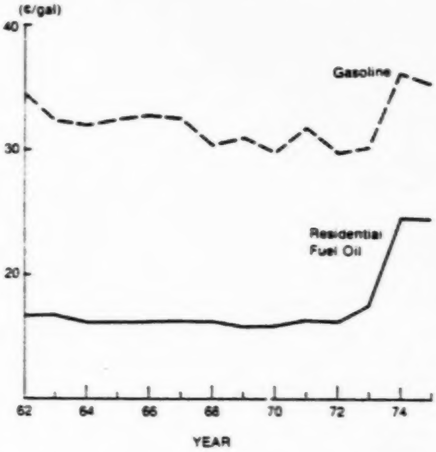
FIGURE 3.2
SHARE OF TOTAL OREGON
ENERGY CONSUMPTION
BY SOURCE



Having no known indigenous petroleum resources, Oregon must import its petroleum products from a variety of domestic and foreign sources. Most of Oregon's petroleum products are delivered through the Olympic Pipeline from Puget Sound refineries. The remaining supply comes from California by way of ocean tankers, rail, and trucks and from Salt Lake City through the Chevron Pipeline.

As indicated in *Figure 3.3*, until the oil embargo of 1973, petroleum prices to Oregonians had been increasing slower than general inflation—a key factor in growing petroleum usage. Future petroleum price trends will depend on a number of uncertainties, especially the pricing policies of foreign countries and the federal government. In terms of real dollars, petroleum prices are expected to increase steadily during the next 20 years.

FIGURE 3.3
GASOLINE AND FUEL OIL
PRICE TENDS
(CENTS PER GALLON — 1967 DOLLARS)



Crude petroleum and refined petroleum products are readily transported throughout the world. Since the petroleum market is of national and international scope, fluctuations in Oregon demand will not significantly affect total supply and demand.

Because Oregon is dependent on an international petroleum supply system, it is extremely difficult to determine the future sufficiency of our supply. However, potential supplies for the Pacific Coast of the United States have been studied.

The draft of an FEA study of the transportation and disposition options for Alaskan North Slope crude oil[2] (*North Slope Crude, Where to?—How?* September 13, 1973) concludes that there will be a regional surplus of crude oil through 1985 of between 600 and 1300 thousand barrels per day. This includes foreign imports of between 300 and 500 thousand barrels per day to meet the technical needs of some refineries. These imports compare with an average of 900 thousand barrels per day in 1975.

In addition, the DOE requested estimates from Oregon's petroleum suppliers regarding the petroleum supply/demand balance on the Pacific Coast for the next five years. The estimates suggest that no general shortages are anticipated during that period. However, spot shortages could occur in some products under conditions such as another OPEC embargo.

Reliable data are not available beyond 1985, but it is reasonable to assume that an adequate supply will exist at a price for some time. It should be emphasized, though, that oil is a rapidly depleting non-renewable resource. World production of oil will begin to decline toward the end of this century, depending on the rate of growth of the use of petroleum products.

Natural Gas

In 1974, about one-fifth of the State's energy requirements were met by natural gas. Although gas consumption grew at an average of 9.5 percent annually from 1962-1973, its share of total energy use has been almost constant since 1968 (*Figures 3.1* and *3.2*).

Three natural gas utilities and a single gas transmission company serve Oregon consumers. Most of the supply, some 64 percent, comes from Canada. The balance is drawn from resources in the Rocky Mountains and the Southwest. Canadian contracts are set to expire in 1981 and 1989, although future extensions may be possible.

In order to offset the impending loss of Canadian supplies, Northwest Pipeline Corporation (NWPC) is attempting to negotiate contracts for Alaska-Prudhoe Bay gas. In addition, exploration is underway to locate new resources in the Rocky Mountain states. In the longer term, synthetic natural gas (SNG) represents a possible resource. The environmental and resource costs of development would be high, however, and SNG development, except in the case of coal gasification, would compete directly with the petrochemical industry for liquid hydrocarbons as feedstocks.

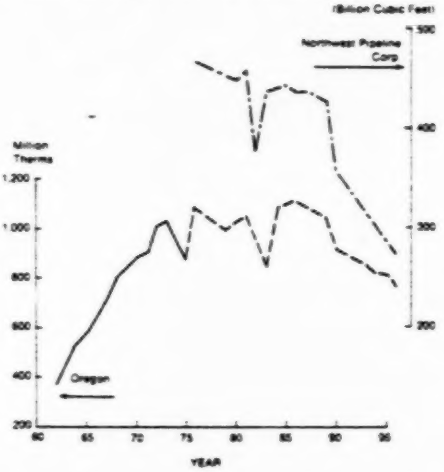
Due to uncertainties surrounding the supply of natural gas, the Department has concluded that it is not prudent to assume that Oregon will have an unlimited supply of gas during the next 20 years. Shortages, however, will likely be limited to industrial users. Residential and commercial sectors can expect to have adequate gas supplies for at least the next two decades.

The supply constraint considered probable by DOE during the forecast period is based primarily on information provided by the State's gas utilities, their supplier, NWPC, and the Public Utility Commissioner.

It is based on these assumptions: (1) the supply of conventional domestic sources to NWPC will decline from 108 billion cubic feet (BCF) in 1987 to 63 BCF in 1996; (2) Canadian imports will be phased out. Northwest Pipeline Corporation's Kingsgate contract expires in 1981, and it will not be renewed. Although the Sumas contract will similarly expire in 1989, some Canadian gas will continue to be available under short term arrangements; (3) Alaskan gas begins to flow in 1983 with NWPC obtaining five percent of this source through 1996; (4) Oregon receives 21 percent of the gas available from NWPC; (5) gas from supplemental sources will be available, increasing gradually from five BCF to 20 BCF per year in 1996.

The resulting natural gas supply forecast for Oregon is shown in *Figure 3.4*. Oregon's projected supply generally reflects the trend of gas available to NWPC. The quantity of gas available to the State holds relatively constant through 1986 at just over one billion therms, declining to 760 million therms by 1996.[3]

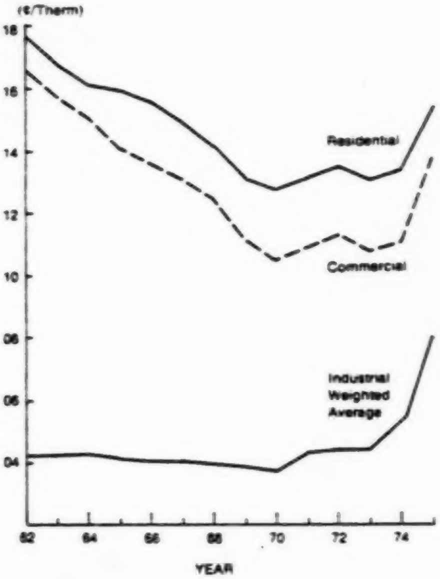
FIGURE 3.4
NATURAL GAS SUPPLY IN OREGON



As with petroleum products, future gas supplies will be increasingly costly in real terms in contrast with past trends (*Figure 3.5*). Future gas prices to Oregon will depend on the sources of supply and on Canadian, U.S., and State policies. It is reasonable to assume that in the long run, the price of natural gas will tend to follow the world price of oil. In the short to mid-term, a faster rate of increase may be expected (see Chapter IV).

For both petroleum and natural gas, State policy options are limited almost exclusively to those affecting consumption.

FIGURE 3.5
AVERAGE PRICES OF NATURAL GAS IN OREGON BY SECTORS (CENTS PER THERM IN 1967 CONSTANT DOLLARS)

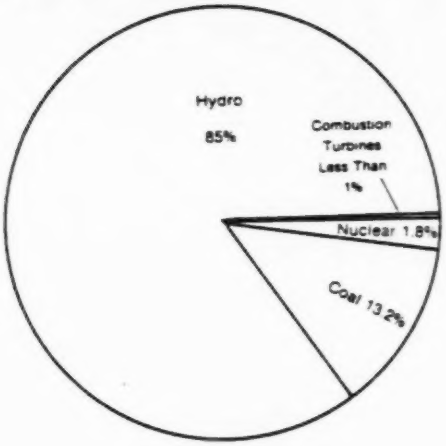


Electricity

Electricity consumption in Oregon amounted to about 23 percent of Oregon's energy usage in 1974. Electric energy usage grew at an average annual rate of 6.3 percent from 1962-1974, while its share of total state consumption increased only gradually (*Figures 3.1 and 3.2*).

Until very recently, Oregon consumers have relied almost entirely on inexpensive electricity generated at the region's federal and non-federal hydroelectric projects. In 1975, approximately 85 percent of Oregon's electricity was produced by falling water (*Figure 3.6*).

FIGURE 3.6
SOURCES OF ELECTRICAL ENERGY CONSUMED IN OREGON IN 1975[4]



However, the energy producing capability of the Northwest's hydro system is almost fully developed. While the system's peaking capability is being increased substantially by installing more generators at existing dams, very little will be added to the total energy generated by the system. Many additional potential hydroelectric sites, which together could add significantly to the electric energy generated by the Northwest system, have been judged unsuitable on economic or environmental grounds.

Moreover, for Oregon the situation is complicated by existing federal law and policy. The Bonneville Power Administration (BPA), which markets most of the region's hydroelectric power, is required by law to give preference to publicly-owned utilities. Under present federal policy, the energy producing capability of the federally built dams is being reserved largely to meet the present and future needs of the Northwest's publicly-owned utilities. The investor-owned utilities, which serve approximately two-thirds of Oregon's electricity consumers, have been gradually cut off from *firm* sources of federal power which supplied them for decades.

Although Oregon's utilities have turned increasingly to thermal sources of power, the State's dependence on thermal power remains limited. In 1975, only 15 percent of Oregon's electricity requirements was supplied by thermal sources (*Figure 3.6*). Virtually all of it was generated by nuclear and coal plants in adjacent or Rocky Mountain states.

Oregon has a substantial amount of combustion turbine capacity. However, construction of Oregon's first coal plant has only just begun in Boardman and the Trojan plant, Oregon's only nuclear facility, has just begun sustained operation.

If electricity demand grows significantly, as it almost surely will, Oregon will have to increase its reliance on thermal power plants. Conventional oil-fired, steam generating plants and gas turbines are no longer attractive alternatives for meeting continuous demands. Escalating natural gas and fuel oil prices, and higher priority uses for gas and oil, have rendered them suitable only for standby, peaking, or reserve service.

In the long-run, sources such as geothermal, solar and wind, may contribute significantly to the State's and region's electric supply picture.

However, nuclear and coal plants appear to offer the only alternative technologies available to Oregon and the region for meeting a major portion of electricity demand growth for at least the next 10-15 years. Due to their lower fuel costs, either can produce large amounts of electricity more cheaply than oil or gas-fired plants. Although both involve uncertainties, most notably the nuclear option, they are available now.

As a result, Oregon's utilities have joined with other Northwest utilities and the federal government to implement a coordinated long-range program of power development. Although the program has undergone substantial revisions, it envisions that growth in the region's demand for electricity during the rest of this century will be met with large thermal (mostly nuclear-fueled) power plants.

Over time, the region's hydro facilities will be used increasingly to follow fluctuations in electrical load and to meet peak demands. Plants are being cooperatively owned and financed by both publicly-owned and investor-owned utilities, with shares of output sold on a regional basis.

The shift to thermal sources of generation has major economic, social, and environmental implications for Oregon and the Northwest. The impacts are quite different from those which accompanied hydroelectric development.

In addition, the real cost of power from thermal sources is several times the cost of power from hydroelectric plants. Consequently, as Oregon's electricity usage grows, consumers will face much higher rates for electricity (see Chapter IV).

In contrast to petroleum and natural gas supplies, the State has major regulatory powers affecting the supply of electricity. By establishing specific electricity rate structures and by approving rate increases, the State makes possible utility management decisions with respect to facility investment choices. In addition, through the Energy Facility Siting Council, Oregon regulates the approval, construction, and operation of power plants built in the State. In the exercise of its responsibilities in these areas, the State becomes *involved* in choices among electrical system expansion alternatives.

In order to ensure that both the financial and environmental impacts of supplying electricity are minimized, it is essential that the need for additional facilities be established as rigorously as possible. In doing this, two issues are of overriding importance.

The first is the *timing of additional generating facilities*. That is, how fast will electricity use grow and when will additional generating capacity be required to meet increased electricity demand? These questions can never be answered with certainty for there are simply too many unquantifiable variables that can influence future levels of demand. Nevertheless, decisions must be based on some specified criteria, and forecasting techniques of some type are invariably used to estimate future usage levels.

In Oregon and the Northwest, utility forecasts have been the primary source of information used to establish the need for additional facilities. *Northwest utilities* forecast an average annual growth rate of 4.4 percent for the next 20 years.[3] Meeting this demand would require almost 2½ times the region's present electric energy generating capability.

Oregon's utilities predict that the State's electricity requirements will increase 6 percent annually during the same period. This implies continued growth at close to historical rates and more than a tripling of generating capability over the next 20 years.

On the basis of its analysis and evaluation, the Department has identified deficiencies in the forecasting methods of Oregon's large investor-owned electric utilities (see Chapter VI). They do not currently provide an adequate basis for determining when additional facilities will be needed. The Department's evaluation of the utility forecasts and its own forecasting work are presented in subsequent chapters.

The second issue which must be addressed concerns the *choice of plant types*. Given a future level of demand for electricity, there are a variety of thermal plant designs and combinations which need to be evaluated to ensure that the system which is built provides electricity to consumers at the lowest possible cost consistent with safety and environmental standards and appropriate reliability requirements.

To accomplish this it is necessary to know what the likely operating characteristics of individual units will be as they are added to the Northwest generating system in future years.

This requires the use of a planning methodology which systematically considers the following factors: (1) daily, seasonal, and annual fluctuations in electrical load patterns; (2) the operating characteristics of the hydroelectric system, (3) probable, as well as critical, water conditions; (4) expected performance and reliability of individual units; (5) future inter-regional sales and purchases of electric energy; and (6) desired level of system reliability.

The Northwest's utilities do not currently give sufficient consideration to these factors in planning future additions to the system. A more careful and rigorous evaluation using currently available planning techniques might well identify a more economical mix of thermal plant types. The Department is developing a method which will facilitate such an evaluation.

Alternative Energy Sources

In the long run, alternative sources of energy will be important to Oregon and the nation. Even if energy consumption remained at present levels, we would eventually have to supplement and replace our traditional, non-renewable energy sources with permanently sustainable ones. The most important issues are how, when, and with what consequences this transition is ultimately achieved.

While the long term significance of the alternate sources is clear, substantial uncertainty surrounds the extent of their contribution to Oregon's energy picture during the next 20 years, the issue of main concern here.

The discussion is limited to sources which presently appear to have the most potential for Oregon. No quantitative projections of the potential contributions or costs of the sources are made; to do so requires a comprehensive look at each possible alternative. This is underway at the Department of Energy and is planned for inclusion in subsequent reports.

Geothermal Energy

Oregon has some of the country's most promising potential and known geothermal resource areas. However, utilization of geothermal energy has not increased rapidly. The reasons for this are complex and include financial, legal and institutional problems, constraints on leasing, and the remote locations of the resource.

Geothermal energy can be used to generate electricity or it can be used directly. Economical electricity generation requires high temperature resources, and none has yet been discovered in Oregon.

Direct utilization of geothermal energy has been underway in Oregon for many years. Currently, the contribution of geothermal energy to Oregon's total energy supply is relatively small, but important. A substantial portion of Oregon's energy needs could potentially be met by the direct application of low temperature geothermal resources to residential and commercial space conditioning, agricultural uses, and to low temperature industrial and commercial uses.

However, the potential for such direct application may be limited. Geothermal areas are frequently not situated near population centers, and their development might require major demographic and economic shifts.

Solar Energy

It is technically feasible to utilize solar energy in Oregon both for the conversion of solar energy to electricity or its direct application to space conditioning and water heating. The main uncertainties regarding the future role of solar energy utilization in Oregon relate to economics.

Although the first central solar electric generating plant will likely be built in a southwestern state, this form of solar energy could be available by the turn of the century.

Due to the region's inexpensive hydroelectric generation, the economics of this form of solar utilization may not be as favorable as in other areas of the country. However, this problem could be offset since the Pacific Northwest hydro system storage capability could be utilized in conjunction with solar electric power.

Solar energy is currently being used for space and water heating in several applications in Oregon. Depending on their technical and economic success, these demonstration projects may be the bellwether of much broader direct use of solar energy in the State.

Energy from Biomass and Waste

Utilization of waste material for its energy content already plays a significant role in the Oregon energy picture. For example, energy from wood waste alone constitutes perhaps 15 percent of Oregon's total energy supply.

There is a potential for much greater utilization of waste materials to produce usable energy. Crop residues, wood waste, municipal waste, and other materials which have often been discarded may well become important sources of energy. It is also possible that certain crops or trees might be grown specifically for their energy potential.

Wind Energy

The generation of electricity is the largest potential use of wind, and Oregon has some promising sites in the Columbia Gorge, northeastern Oregon, and along the Oregon coast.

Wind generation is a fairly well-developed technology which has seen some application in the United States and Europe. The unpredictability of the wind is a major problem in utilizing wind generation, and either a back-up or a storage system is required.

The Northwest's hydro system might offer a storage system for use in conjunction with wind power. If the costs of wind generated electricity are found to be competitive with thermal plants being planned for the mid 1980s or beyond, wind could play a more significant role in Oregon's energy future.

There are several additional points to be emphasized in discussing energy alternatives. *First*, it is difficult for a single state to influence the rate of development of major new energy technologies. In many cases, the technical, economic, and policy developments are outside Oregon's control. The State's human and fiscal resources are limited when compared to the magnitude of the research and development efforts required.

Second, under present national research and development plans, prototype plants for several alternate energy technologies will not be completed and in operation until the late 1970s or early 1980s. The results of these experiments will allow better estimates of how rapidly a given source may be developed.

Third, if Oregon is to most effectively utilize alternative energy sources, the appropriate groundwork must be laid. It must provide an atmosphere which is receptive to the development of alternative energy sources by removing barriers to their development. The State could also undertake a program of resource assessment in the next few years so that timely advantage can be taken of the findings of national research efforts when they become available.

It would also be useful to pursue alternatives where individual state efforts may make a big difference. These include geothermal, direct solar utilization and energy from waste and biomass.